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The Journal
OF THE
Ministry of Agriculture

VOL. XXX.

APRIL, 1923, TO MARCH, 1924.

LONDON.
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE
AND PUBLISHED BY THE MINISTRY OF AGRICULTURE AND FISHERIES,
WHITEHALL PLACE, LONDON, S.W.1.

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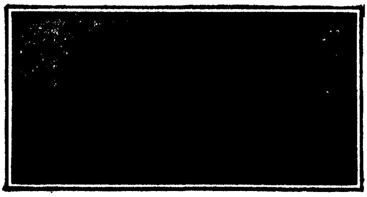

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXX. No. 1.

APRIL, 1923.

NOTES FOR THE MONTH.

Store Cattle from Canada.

THERE appears to be every prospect that the facilities which Parliament provided last Session for the landing of Canadian store cattle in this country will be taken advantage of by farmers in Canada, and the Canadian Government is now giving advice through the Press and in other ways as to the steps to be taken in regard to this trade. It is pointed out that the essential factors are quality and price. From the point of view of quality, the Canadian Government is insisting with producers that the only way to provide store cattle of the right type and quality for the British market is to use pure-bred sires. Three or four-year-old unfinished cattle, it tells them, are of no use to the British market and would not return a profit. It advises them that the right cattle for this market should be two-year-old stores of about 1,100 lb. in weight, well-fleshed, and with the breeding necessary to take a proper finish. Quite recently, the Deputy Minister of Agriculture has announced the Government's intention of introducing a Bill to establish a quality standard for export cattle. The Canadian producer is also being told that the British market is open to take winter-fed cattle of medium weight from the middle of March to the end of May; well-finished grain-fed cattle for immediate slaughter in May and June; and grass-finished cattle from Western and Eastern Canada from August to November.

With regard to the question of the probable price of stores at the present time, the Deputy Minister is reported to have said that the average cost of transporting animals from Winnipeg into the hands of the British farmer would be £9 to £10, and that the animals might be expected to fetch about £23 10s. or £24 each.

Regarding the question of the arrangements which have been and are being made for the reception of Canadian store cattle at ports in this country, the Importation of Animals Act, 1922, will come into operation on 1st April and landing places will be available at Birkenhead, Manchester, Glasgow, Dundee and Cardiff. The port of Bristol is expected to be added to this list shortly, and proposals are also being made in respect of the ports of Aberdeen, Leith, Newcastle, Hull, Harwich, London, Southampton and Falmouth. Though it cannot be foretold whether all of these ports will be open or not, it is not anticipated that the facilities for the landing of Canadian cattle will be in any way inadequate. The provision of such facilities is not undertaken by the Government but is a matter of private arrangement, though the accommodation when provided has to be approved by the Ministry of Agriculture. The first five ports mentioned can together take 5,000 Canadian animals at a time, quite apart from the provision that may exist at them for Irish animals, and can take three lots a week. There is, therefore, accommodation for about 15,000 animals per week. The most recent estimates of numbers likely to be landed from Canada are 20,000 to 25,000 in April and May, and 100,000 altogether this year. The Canadian Government has, however, informed its breeders and feeders that the British market is capable of taking about 300,000 store cattle and 400,000 fat cattle every year.

Turning to the administrative machinery which is being set up to deal with the traffic, the Ministry of Agriculture passed two Orders on the 9th March, the first known as "The Importation of Canadian Cattle Order of 1923," and the second "The Canadian Cattle (Marking) Order of 1923," both to come into operation on the date on which the Importation of Animals Act, 1922, comes into operation, *i.e.*, on the 1st April. The first Order sets out the general conditions as to landing, disease in a landing-place, temporary provisions in the event of disease in the Dominion of Canada, movement of the cattle from the landing-places, cleansing and disinfection of vessels, protection and feeding of animals on board ship, etc. The second Order requires all Canadian store cattle coming to this country to be permanently marked before shipment for the purpose of identification in this country.

* * * * * *

Agricultural Wages.

IN the course of a discussion on agriculture in the House of Commons on the 5th March, the question of the insufficiency of agricultural wages was raised by Mr. Hope Simpson. The Minister of Agriculture, Sir Robert Sanders, in reply said:—

"In regard to the wage question—and I am glad my hon. friend referred to it—let me say that the average wage, taking the country throughout at the present time—and I only want to state facts, and not to make any comment upon them—the average wage, so far as we can ascertain, is 27s. 9d. The increase on the pre-War wage is 54 per cent. The increase in the cost of living is 77 per cent., so it is, undoubtedly, the fact that the agricultural labourer's wage is lower in proportion than it was before the War. The present means that we have for regulating the wages are the conciliation committees that were established by the Agriculture Act of a little over a year ago. They number 63 in England and Wales. Up to last autumn they were working pretty well. Arrangements were come to by 46 of the 63 committees. Up to the present time only 16 of the committees have effected arrangements, and six of these are due to expire at the end of April. What is happening now in most cases is that, when the National Farmers' Union have laid down the rate of wages for a county, that rate laid down is generally paid. In most cases the men's representatives refuse to accept that rate or to bargain on that basis. I have reason to believe that one of their reasons is that, although that rate may be laid down by the National Farmers' Union, there are a certain number of farmers in the district who, in spite of it being laid down by the Union, will continue to pay a higher rate for a time; and there has been a fear on the part of the men's representatives that if they entered into an agreement on the basis of those wages paid by the farmers, some of them would be getting, not a higher, but a lower wage. No doubt that does happen in a certain number of cases, but such cases tend to get fewer as time goes on, and although a man may pay a higher rate for a bit, when he finds his neighbours paying a lower rate he will come down to the same level. Cases occur in many counties where individuals pay a lower rate than the National Farmers' Union has laid down, and in the absence of a general agreement which might be effected, but is not being effected by the conciliation committees. such cases are likely to get more numerous. I believe that for the conciliation committees to come to an agreement in the majority of cases instead of as at present a very small minority would be in the interest both of employers and employed, and both of the farmers and the workmen. I am only too anxious to get the conciliation committees to function again. One difficulty one has to deal with is the want of elasticity in the powers of both sides. The Farmers' Union say what they think the wage should be. The Labourers' Union say what they think the wage should be and then representatives, if they come in at all, come into the conciliation committee not as plenipotentiaries but with their hands tied on both sides. When you have these cast-iron terms arranged beforehand agreement is very difficult if not absolutely impossible. I believe if we can get these conciliation committees to function it will be a good thing all round. That is what I am trying to do.

I am considering now addressing a communication to the members of these committees, suggesting the terms on which they might meet. I thank the Hon. Member opposite for the suggestion he has made as to registering agreements. I will certainly consider that, but I am not sure how far it would tend to promote more agreement. I am not sure it might not tend to promote less agreement. I think it is quite possible that although one side might attach great importance to registering, the other side might be less willing to come to an agreement if it knew that that agreement were going to be registered. I will certainly take these considerations into account, and I hope what has been said to-night may be helpful in making things, a little better in what is one of the very greatest and very saddest of the difficulties that agriculture has to deal with at the present moment."

THE circular letter referred to above in the speech by Sir Robert Sanders was sent to all Chairmen, Secretaries and Members of Conciliation Committees on 14th March, and is as follows:—

Letter to Conciliation Committees* from the Minister.

"I am much concerned at the slow progress which is being made by Conciliation Committees in arriving at agreements for wages in their districts. I am fully conscious of the difficulties of the present situation, but there are grounds for making a special effort at the present time. Although prices for some farm produce, particularly potatoes and cereals, are low, on the whole there has been little change during recent months, while for certain classes of produce prices are moderately satisfactory. From the workers' point of view it may be said that the cost of living shows no tendency to rise, so that it is, if anything, to their advantage to come to an agreement as to wages under existing conditions.

---

* Particulars as to further agreements made, see p. 85.

To make agreement possible, I would particularly urge the advisability of organisations of both employers and workers allowing their representatives on the Conciliation Committees as far as possible a perfectly free hand in negotiating wage agreements. I feel somewhat strongly that on certain Committees amicable agreements would have been arrived at by the members concerned if they had not felt themselves rigidly restricted to precise terms laid down by their organisations. The essence of the Conciliation Committee system is that properly accredited representatives of the two parties should meet together with an open mind in an endeavour to come to an agreement reasonably satisfactory to both sides. A meeting between representatives whose action is limited by conditions laid down beforehand is necessarily likely to be unfruitful.

I hope, therefore, that all the Committees which have not yet reached agreements for the current year will arrange meetings as soon as possible with a determination to make every effort to arrive at settlements to cover the forthcoming season, and that the representatives will go to the meetings prepared to discuss the problems in a spirit of earnest goodwill, and, if necessary, to offer adjustments in order to arrive at a reasonable compromise. I need scarcely add that I shall at all times be glad, as hitherto, to place the services of suitable officers of this Department at the disposal of the Committees for the purpose of attending meetings in a purely advisory capacity."

* * * * * *

The Colorado Beetle.

A NOTE on the fact that the Colorado Beetle—the pest of potatoes so dreaded in the United States—has again obtained a foothold in Europe, was published in this *Journal* for February last, p. 1053. A leaflet on this pest was published as long ago as 1902, and in view of the proximity of this country to France—where the outbreak mentioned has occurred—the Ministry has prepared (1) A new edition of the leaflet, and (2) a small poster showing the insect in colour. In view of the dangerous nature of the Colorado Beetle the possibility of its finding a way to Great Britain is a serious one. It is therefore highly desirable that all who have anything to do with growing potatoes in the British Isles, or with their importation from the Continent—especially France—should be on the look-out for the beetles. In order to aid readers of this *Journal* in identifying the pest if it should make its appearance, the leaflet re-written in February is reprinted at p. 59.

* * * * * *

DEPUTATION TO THE PRIME MINISTER

FROM

THE NATIONAL FARMERS' UNION, THE NATIONAL UNION OF AGRICULTURAL WORKERS, AND THE AGRICULTURAL SECTION OF THE WORKERS' UNION.

This Deputation was received on the 16th March by the Prime Minister who was accompanied by the Rt. Hon. Sir Robert Sanders, Bt., M.P. (Minister of Agriculture), Sir Francis L. C. Floud, K.C.B., Mr. J. C. Davidson, C.B., M.P., Mr. G. Fry.

The Deputation consisted of Mr. Harry German (President, National Farmers' Union), Mr. T. H. Ryland (Vice-President), Mr. R. R. Robbins, Mr. Henry Overman, Captain Fyfe (Parliamentary Secretary), Mr. J. B. Guild (Statistical Officer), Mr. J. F. Wright, Mr. R. B. Walker, Mr. W. Holmes, Mr. George Edwards, Alderman Beard, Mr. George Dallas, Mr. E. W. Langford.

Mr. Charles Duncan, M.P., introduced the Deputation, Mr. Walker stated the case for the agricultural workers, and Mr. Robbins made a statement on behalf of the Farmers' Union.

Mr. R. B. Walker: Mr. Prime Minister, on behalf of the Workers' side I am asked to submit to you this statement, and I will hand a copy in to you. In thanking you for the opportunity of this interview, especially in the light of present circumstances, I desire to say that the extreme urgency of the situation as we see it is the only explanation we have to offer for encroaching on your time at the present moment.

Since the cancelling of the Agriculture Act and the abolition of the Wages Board, agriculture has been dependent upon Local Conciliation Committees as the means of adjusting differences upon wages, etc., in the industry. These have been in operation for some eighteen months, and have produced various agreements. It has been evident, however, for some time that the further they have proceeded the more difficult has become their task. At the present moment there are, in fact, only agreements in 13 districts out of 65, and these being for a short period it is doubtful if they will be continued. It will, therefore, we fear, be impossible to avoid a complete breakdown of the machinery.

Briefly, the facts are that offers of wages now made by the employers are such as the workers cannot live upon, as low as 20s. 10d. per week or 5d. per hour being the terms offered. This means, having regard to the present cost of living, a much lower standard than that which obtained in pre-war days, and which by general consent constituted nothing short of a scandal in rural life. With the best will in the world to use the machinery of conciliation to its fullest extent it must be obvious that we cannot give our sanction and support to a condition of things which takes the agricultural labourers back to a position so much worse than that which has been so severely criticised in the past.

With a desire to do all that it is possible to keep our relationship with the employers on a basis of harmony and goodwill, we have met the Central body of the Farmers', Union to ascertain whether it is possible for some action to be taken nationally whereby the difficulties that have arisen, and which are likely to arise, could be removed from their local bearings and dealt with on national lines as is prevalent in other industries.

The situation is one of great seriousness, and the proposed wages and conditions have given rise to grave misapprehension, and it is difficult to say what may eventuate therefrom. The situation is one, therefore, of great urgency, as already in various counties, men are being locked out because they cannot agree to the reductions of their wages and the increase in their working hours.

We who are acting for the labourer are not actuated by any narrow interest so much as by a desire to secure national well-being by the obtaining for the rural worker conditions which will give him satisfaction in the present and hope for the future. To this end we therefore ask the Government to at once re-establish the Agricultural Wages Board.

Mr. R. R. Robbins: Mr. Prime Minister :—We are conscious of the burden of foreign and domestic problems which continue to weigh upon yourself and your colleagues, and we realise that the condition of agriculture has engaged your serious attention since you assumed office. We desire to place before you, very shortly, our views on the two issues with which you are confronted, viz. :—

(1) The fundamental question of national policy, and

(2) The question of the immediate relief to be afforded to the industry.

The first issue, Sir, is one of supreme national importance, but it may be reduced to very brief terms. That is to say, the Government must state clearly and unequivocally what it expects from the industry and whether it desires the industry to be conducted on a strictly economic or individualist basis or upon a political and social basis. If the Government intimates its desire to see the industry organised on a strictly economic basis it must be prepared to face uncomplainingly diminished food production, diminished rural population, and the consequent flocking of the rural population to the towns, the laying down to grass of all but the most fertile lands and the reversion to what is known as "ranch farming." Further, it should in justice to the industry repeal the Safeguarding of Industries Act and remove all other forms of protection and all subsidies granted to other industries in this country, as well as cease to subsidise the development of agriculture in the Dominions through the Empire Settlement Act.

If, on the other hand, the Government decides that in the interests of the State it is necessary to reduce our dependence upon imported food supplies to a minimum, to secure an output from the soil in excess of the economic maximum, and to retain or increase, at an adequate living wage, the existing numbers of workers employed on the land, then this involves the organisation of the industry upon a political and social basis and imposes upon it services of a non-economic character for which the nation must be prepared to pay.

Upon this fundamental issue we understand that you prefer to reserve final judgment pending the receipt of the Report of the Tribunal of Economists which you appointed with the full approval of all parties in the House of Commons "to enquire into the methods which have been adopted in other countries during the last fifty years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labour at a living wage and to advise as to the methods by which those results could be achieved in this country."

We acknowledge the tribute to the importance of the issue raised by us implied in the appointment of this Tribunal of eminent economists and in the respect shown in anticipation to their judgment. At the same time, Sir, we would respectfully remind you that the progress of events since the appointment of the Tribunal has very much increased the urgency of a decision, and we express the hope that this will be forthcoming at the earliest possible moment.

We now turn to the second issue confronting the Government, which is our primary concern to-day.

At the Old Kent Road Baths, in the course of the General Election, you stated: "I am afraid we are coming into conditions almost as bad as in the 'eighties. . . . There is one thing I do say that, in addition to the need which the actual condition of agriculture produces of doing our best to help it, it has another claim. The way in which agriculture has been shoved from pillar to post, by passing Bills and then repealing them, has enormously aggravated the position of agriculture. For that alone, we owe them some compensation." This statement of yours has been accepted by all sections of the industry as proof that you are not unmindful of the very serious difficulties in which the industry finds itself, due to circumstances beyond the control of agriculturists. Since that date, however, the gravity of the situation has increased. As you have no doubt learnt from the Press, arable farmers in Norfolk find themselves unable from their depleted resources to add to the wage of 25s. which they have recently been paying for a 50-hours' week, and are compelled to ask their workers to accept the same wage for the longer hours required to overtake seasonal work.

Such is the recommendation issued by our Norfolk County Branch to its members in order to maintain the present weekly wage to workers, and we are sure that the farmers will respond to the absolute limit of their financial resources. We are afraid, however, that in some cases their limited resources will render them unable to employ the men for more than 50 hours at the lower rate. The recommendation of the County Branch is, of course, equivalent to asking the worker to accept a reduction in his wage rate of ½d. per hour. The prospect before the worker is indeed deplorable, but on the other hand it is almost impossible to exaggerate the gravity of the position in which very many of those whom we represent are placed. As events are moving, the position to-day in Norfolk will to-morrow be the position throughout the whole of England and Wales wherever the farmer depends to any considerable extent upon arable farming.

If this is allowed to take place, we fear that it may have consequences which will prevent the discussion of principle in that sane and deliberate way in which alone a question of such vital national importance should be discussed; we fear that it will put beyond the reach of help many employers and many more workers now engaged in the industry, and that it must involve a serious economic loss to the community, whatever may be the ultimate decision of the country which will govern the conditions of food production and rural welfare for the future. Holding these views, we felt that we should be lacking in our duty to those whom we represent and to the country if we did not approach you, Sir, and ask you to receive this deputation so that we could lay them before your Government in this the most direct method open to us.

The crisis has not come upon us without any warning. Many months have elapsed since we saw signs of what was coming. In August of last year we sought an interview with the Minister of Agriculture of the late Government and placed before him the information which had reached us from all parts of the country. Later in the year there took place a series of conferences between the employers' and the workers' organisations on the position of the industry. These conferences were of a very frank, and we think we might add, of a very friendly, character, and raised high hopes throughout the countryside. The facts of the position were fully discussed, but it was felt that no useful constructive discussion could proceed without a clear definition by the Government of the fundamental basis upon which they wished the industry to be conducted. It is unnecessary for us to recall the circumstances in which we failed to obtain such a definition from the late Government. Since you assumed office we have continued independently to press this question.

Pending your decision, however, on the Report of the Tribunal of Economists, we regard it as essential that some immediate temporary steps should be taken to deal with the situation now existing. Unless means can be found to cope with it, then undoubtedly we are faced with the certainty of a great addition to the number of unemployed agricultural workers, a decline of wage rates to a figure which we hesitate to forecast, and an enormous increase in the already rising numbers of agricultural bankruptcies.

On the latest official returns of prices published by the Ministry of Agriculture and taking also the official returns of the average yield per acre for the various crops, the return to the farmer to-day is only £9 per acre for wheat, about £7 per acre for barley and oats, and £10 per acre for potatoes.

Upon detailed costings which are laying before the Tribunal of Economists, and which have been compiled from independent scientific sources, these returns represent a loss of at least £2 per acre on wheat, £3 per acre on oats, £4 per acre on barley, and from £10 to £15 per acre on potatoes. These losses, coming on top of serious losses in the preceding year, are altogether beyond the depleted resources of the arable farmers in this country to cope with.

The farmer cannot shut down his farm in the way in which a manufacturer can temporarily close down his factory. There are, however, certain steps which the farmer can take to reduce his commitments, but any such steps once taken are difficult—and indeed impossible within a short period—to retrace.

On land that is suitable for laying down to grass, he adopts this means of reducing his commitments. On the land that remains under the plough, if he has the considerable capital required and the covenants of his tenancy agreement permit, he achieves approximately the same results by removing hedges, by laying field to field, and by cultivating on a less intensive scale larger areas.

But on the considerable areas of light land in this country at present under the plough which are not suitable for laying down to grass, we are afraid there is little prospect before us but to see these lands go derelict, to become game preserves, while their present occupiers are driven out of the industry either via the Bankruptcy Court, or otherwise.

You yourself, Sir, have said that you are afraid that we are coming into conditions almost as bad as in the 'eighties. In the 'eighties the situation similar to that which we have just described developed very slowly. To-day it is developing very rapidly. They present a prospect which we regard with dismay, but by ourselves we are powerless to avert it. We therefore ask you seriously to consider whether, pending a final decision on the question of permanent policy, some temporary measure of assistance cannot be devised by the Government which would at any rate alleviate the present degree of distress. Such a measure we believe is urgently required in the national interest, having regard not only to the immediate prospects of a serious extension of unemployment and destitution in the countryside reacting upon the towns, but also to the danger that the present rapid course of events, if unchecked, may seriously prejudice the future permanent conditions of food production in this country.

The Prime Minister: Gentlemen, we quite realise the serious position of agriculture. This is the second year in which your capital has been depleted, and it is obviously a very serious situation. At the time of the election I had the facts well in my mind, and perhaps you will remember I stated what was the general policy of the Government as far as I could at the time. What you seem to ask is that something should be done by the Government to prevent the fall in the production of foodstuffs. It seems to me that that is only possible in one of two ways, either by a big subsidy, the extent of which no one can foresee, or by protection.

As regards the subsidy, you know that that was tried, and that it was found impracticable, and I do not think there is any possibility of any large subvention by the State to this industry to help it to get on to an economic basis. As regards protection, I think you know as well as I do that the public is not ready for that, and you could not get a majority for it. That also seems to be shut out. I said in my letter of November the 9th that that could not be done, but I indicated some other means by which the industry might be helped. These means were in relation to credit facilities, rating, education and adjustment of prices. All these have been taken up by the Government. You know that a committee is sitting in regard to the difference in prices paid by the consumer and the prices at which the commodities are issued by the farmer. A Credit Facilities Bill is being prepared and will be introduced very shortly. The same is true with regard to rating, though that is a difficult problem, and it is possible that we may not be able to deal with that this year, though I hope we shall. But with regard to your larger questions, I do not see what can be done, or what you could expect the Government to do. You come to me and say the position is very bad, and you ask the Government to put it right. We should be only too glad if we were able to do so. We realise the position in which your industry is placed, but I do not see any practical scheme by which that can be done. As regards the Committee of Enquiry, which I hope will report shortly, I do not know what they will recommend: we will have to consider their report when it comes. I am sorry to say that on the big question, which filled everybody's mind during the war—when everybody felt the urgent necessity of increasing agricultural produce, steps were taken to secure that increase. But the area of the arable land which was thereby increased has apparently gone back to what it was before the war. I am sorry indeed to have to give so discouraging an answer. But, unless you have yourselves some practical suggestion to put to me, it comes to this, does it not? You say the industry is so bad that if there is to be proper food production at home, the Government must do it. How can that be done?

Mr. G. Dallas: What about the case of the agricultural labourers? It is obvious that their position is terrible, and it is becoming more terrible. We know that the farmer does not contend in any way that it is not. The labourer is at present right down to the bottom.

The Prime Minister: I admit that, and I cannot say anything about the dispute that you are having with the farmer. But it comes to this: Is the industry to be self-supporting, or is it not, and you have to bear in mind, after all, that what agriculture is suffering now is a direct result of the war. I think that the agricultural industry is in a worse position than almost any other industry, but they have all suffered; but the question is, is agriculture to be self-supporting or to be supported by the State? I think the latter is impossible. I would like if I could to make you realise that if there were any way, we would like to help you, but it seems to me that agriculture must live on an economic basis.

Mr. Duncan : If it can.

The Prime Minister : If it can, and do you not think you are exaggerating a little about land going out of cultivation? From all I have gathered and tried to understand of this particular matter, I do not think it should be worse than pre-war.

Mr. German : It is much worse than in 1914.

The Prime Minister : If it can, and do you not think you are exaggerating a tinue, surely.

Mr. German : From the figures given me as President of the Farmers' Union and my colleagues for the Tribunal, it is obvious that it is impossible to produce cereals at the present time at anything but a loss.

The Prime Minister : But it is the fact, is it not, that few British farmers produce cereals alone.

Mr. German : Many of the East Anglian, East Yorkshire, the Wolds of Lincolnshire, Suffolk, Huntingdonshire, Cambridge farms are practically engaged solely in arable farming, and you come down again into parts of Wiltshire and Hampshire, where cereals cannot be made to pay : it is impossible. In Sherwood Forest, Nottinghamshire, we have no grass land of any value. They keep stock, and if they keep stock in fair condition up to the second week in August they starve afterwards.

The Prime Minister : If that is true, and I take your word for it, there still is no remedy except one of the two I have named. You see if one were to contemplate the State giving a subsidy to agriculture there is no end to it.

Mr. Walker : You would admit, Mr. Prime Minister, that we are faced with a very serious crisis in the industry?

The Prime Minister : Yes.

Mr. Walker : Would it be reasonable in your opinion if I suggested that surely there is a duty devolving upon the Government to deal with a crisis such as that?

The Prime Minister : But where is it to end? At the time of the war there was an attempt made, as you know, and I think that the way agriculture " has been moved from pillar to post," as was quoted by Mr. Robbins, is a very serious thing, but the attempt was given up as quite impracticable. What are the methods?

Mr. Walker : Please do not misunderstand me. I am not suggesting any method. We have come here this morning and placed what are the facts of the crisis before you, and we rather feel it is the duty of the Government, when we, who are involved and engaged in the industry, have placed these things before you—to do something. It is a serious matter.

The Prime Minister : But the Government cannot deal with that.

Mr. Walker : So that the Government cannot deal with the crisis that has arisen?

The Prime Minister : I think that, like every other industry, agriculture must be self-supporting. That is what I mean. Of course, if you ask me about wages, I think it is a deplorable thing to go back in that respect.

Mr. Walker : We are not going back : we have gone back.

The Prime Minister : They are threatening to go further back.

Mr. Walker : And the Government, in the light of that information, through you, Sir, feel that they cannot do anything whatsoever.

The Prime Minister : I do not see anything.

Mr. Dallas : Did it come to your knowledge that in discussion amongst the agricultural labourers hundreds of them and their families are seeking relief from the Poor Law Guardians?

The Prime Minister : Yes, I am aware of that.

Mr. Dallas : Men in full employment.

The Prime Minister : You do not need to say anything to make me realise how serious the position is, but I do not see any remedy.

Mr. Beard : Which means that that does constitute itself into a subsidy at the present time?

The Prime Minister : Indirectly, yes.

Mr. Duncan : The worst form of subsidy, I should say.

The Prime Minister : Yes, it takes us back to the period before the reform of the Poor Law.

Mr. Duncan : Could you say whether there has been any serious consideration given to the question of subsidising in some form the industry as it stands at the present moment? I do not know on what lines any subsidising would take place, but you suggest that there would be no limit to it. You could limit it.

The Prime Minister : When once you begin, it means the whole industry does it not?

Mr. Duncan : That would be largely a question for the farming industry to give you some information on, but there could be some limit.

The Prime Minister : I do not see it, if you once begin it. My opinion is that yours is much the more serious question, but yours is not the only industry that has come to us with the same complaint.

Mr. Duncan : The only point about that is that the other industries are showing some signs of improvement; we can see that in the various branches of the Trades Unions—we do know that it is beyond question that there is an improvement taking place. We are in touch with 2,000 branches up and down the country, and we can feel that there is an improvement taking place in industry.

The Prime Minister : I think that is true.

Mr. Duncan : It is not as fast as we would like, but it is there.

Mr. Walker : I want it to be quite clear that we have submitted our joint case, but we are not committing ourselves this morning to any particular policy in the statements we have made. We think at the moment that it is the duty of the Government, faced with the crisis that you have admitted exists, to tell us if they are prepared to deal with it. We have got your answer, very clear and plain, and very unsatisfactory from our point of view.

The Prime Minister : I realise that.

Mr. Walker : We must take that answer. We are not prepared this morning to offer any policy; we think that is the duty of the Government.

The Prime Minister : I quite understand that you should think so, but we have carefully considered the possibility of that. We do not think it is possible.

Mr. Walker : To do anything?

The Prime Minister : Not in that way.

Mr. Walker : We are not suggesting any way.

The Prime Minister : It does mean a subsidy, does it not?

Mr. Duncan : It is one of two courses, is it not?

The Prime Minister : Yes.

Mr. Duncan : On this side of the table we do not commit ourselves to any suggestion of policy, but you have explored the situation?

The Prime Minister: We have.

Mr. Duncan: And seen whether there are any possibilities in it.

Mr. Dallas: Our position is quite clear on that. As representing the labour side we are not suggesting any subsidy at all. We are confining ourselves to saying that we think a Wages Board should be established. On the other hand, our employer friends, with whom we are on the best of terms—there is no quarrel between us—are looking at it from their point of view, and they think there should be some subsidy; but we are only putting the labour point of view. We have not suggested how the money should be found at all. If it was desired by the Government, we should not be afraid to get down to that. But we say to the Government that we had a Wages Board once upon a time, and it was an immense advantage to the workers. It has gone, and it has left us in a deplorable condition. We think it would help the labourers very much indeed if that Wages Board was re-established.

The Prime Minister: A Wages Board existed in good times, that is the difference. I am really very sorry not to be able to give you a more satisfactory answer, but we are doing everything that we promised to do for the industry. The real question is: Are we prepared to say that the industry is to be conducted on an economic basis. I will say nothing about the advisability of protection, but it is obvious that it cannot be done until the country is in favour of it, but it is not to-day. I am sure it is not.

Mr. Robbins: The organising of the industry on a strictly economic basis would involve untold hardship not only upon a large number of farmers but upon a very much larger number of workers. During the transition' period the distress would probably be appalling.

The Prime Minister: I have tried to understand this question as well as I can, and I am inclined to think that it is an exaggeration to say that the position is getting worse than in pre-war days. It may be bad at present, but in the long run I think it will not be so.

Mr. Walker: I wish I could make myself believe you are correct.

Mr. Duncan: It depends upon how long the " long run " lasts.

Mr. Walker: The employers are quite capable of placing their own case before you, but I came across a case the other day—I give you this as an illustration—where a man, his wife and family, when the wages at the end of the week—working a full week—were distributed amongst the family, it allowed 2½d. per meal per head of that family per day. How can people live or even exist on such a miserable pittance as that?

The Prime Minister: I agree.

Mr. Walker: It is in that crisis and that position that we want to know if the Government have any suggestions to make whereby that position can be alleviated in some way. If you say " No," I suppose, as head of the Government, we have to take your answer.

The Prime Minister: The Government have considered the matter most carefully, and we do not see how we can give a subsidy to your industry; that is what it means.

Mr. Walker: It must be clearly understood that I am not advocating anything. I have only put forward on behalf of the workers a certain suggestion.

The Prime Minister: I have to consider how the suggestion can be adopted.

Mr. Walker: Quite, and if you had submitted proposals to us we should have considered those proposals and perhaps assisted you in every possible way.

The Prime Minister: I can only repeat, I think you must be taking the worst view of the situation. I have had deputations from other industries pressing the same thing. There is really no end to it. They treat the industry in each case as if it could not be self-supporting, and you know the financial position of the country, how unable it is to meet all these demands.

Mr. Walker: I take it you will agree, Mr. Prime Minister, in the importance of the industry to the common weal?

The Prime Minister: Yes.

Mr. Walker: I think that it is in the interests of the nation that food production should be maintained. We were told by yourself and others that we should never go back, as far as agriculture was concerned, to pre-war conditions, in the interests of the country itself.

The Prime Minister: I do not remember saying that.

Mr. Walker: It is convenient to forget sometimes, but at any rate you were associated with individuals at the time who did say that.

The Prime Minister: I admit that, but it must be admitted from the point of view of those who said that, that they tried to do it and found it impossible. There really is only one remedy, and that is protection.

Mr. W. Holmes: You stated, Mr. Prime Minister, that the conditions in the industry were good when we had the Wages Board; but is it not the fact that a Wages Board could at least prevent the chaos that exists in the industry at the present time? For instance, I find that in my experience in the county of Lincolnshire we have four or five different sets of wages all within a five miles radius, and in some cases there is a difference of 6s. or 7s. a week. If there were some means of State regulation it would probably help the employer—at least, what one might term the good employer, the person who always wants to pay a decent wage if he possibly can.

The Prime Minister: I am afraid that to press that you would have to come as a deputation by yourselves.

Mr. Charles Duncan: It is only fair to point out that the Corn Production Act fixed the limit at 25s. That is what we are pretty well down to now again; in some cases it is getting less.

The Prime Minister: The average is still above that. It is very low, taking into account the cost of living.

Mr. German: What Mr. Holmes said might be so quite easily, because you might have a circle of parishes where one or two might be good mixed farms, while the next might be very poor arable. It is quite easy to get that state of affairs under the conditions I mention.

Mr. Walker: It is a very deplorable condition of affairs.

Mr. German: I agree.

The Prime Minister: I cannot take any part in a dispute that is going on, but I am sure the farmers do not wish the wages to be brought below a subsistence level.

Mr. Walker: It is being done.

The Prime Minister: It is not being done willingly by the employers, I am sure of that.

Mr. Walker: Anyhow we have to try and exist on it.

The Prime Minister: In every business you have to take the good with the bad. Farmers had a good time during the war. That, no doubt, is taken into account now. I do hope that you are exaggerating what the future condition of the industry will be. Agriculture is not only bad in this country, but everywhere. Surely there is a hope that this will be the last year when farmers actually lose money.

Mr. Robbins: The position is aggravated by the fact that not only have wages fallen to a figure which we deplore, but the cost of living has not gone down in proportion to the lowered prices that we have been receiving for our produce. That aggravates still more the position of the worker.

The Prime Minister: I quite see that, and of course I see in your statement, which I have carefully looked through, that you mention the question of the Safeguarding of Industries Act. That does not affect the farmers' position. There is really nothing in that. If it were protecting other industries you would be right, but it is not.

Mr. Robbins: Foodstuffs are being imported into this country below the cost of production in the country of origin.

The Prime Minister: I know; but you have to take what the real feeling of the country is. Supposing we had suggested including agriculture in the Act, the country would not have agreed; at least, that is my view.

Mr. German: You say you hope that next year will be a better year. I was one who lived and worked as an agricultural auctioneer all through the '80s and the '90s, and I was absolutely in touch then. I am farming in several parts of England to-day arable and mixed land, and with this spring, from what I can foresee, I look upon this present year as going to be worse than the last.

The Prime Minister: It is no good my putting my hope against your opinion, but I had hoped the reverse.

Mr. German: I hope so also, but the mistake which the agriculturists made in the '80s and '90s was that they were always hoping. I do not see how the farmer can go on to-day. I would not like to encourage him.

The Prime Minister: Is it not a fact that, in spite of the bad position, when farms become vacant they are easily let, even to-day?

Mr. German: I absolutely admit that is the case with regard to grass farms and mixed farms; but take the Press and look at the big arable farms—you will find a lot of those to let. Only the other day I was told by the farmer on an estate I am managing that he could not stop at the present rent, although that was only 14s. an acre. I dare not face the risk of losing the tenant and re-letting these 600-acre arable farms, so reduced the rent.

The Prime Minister: The reason I said that was because I have been given figures of farms that have been to let over the whole country, and they have been taken very readily, which shows that farmers are not so hopeless as you seem to be about the future.

Mr. German: The same thing existed in the "eighties." When you have men who have only one trade they stick to that trade. They did in the "eighties," and I think they are taking the same line now.

The Prime Minister: There is a danger of that, I quite agree.

Mr. Walker: I take it that so far as the Wages Board suggestion is concerned, the Government cannot entertain the proposal in any shape or form?

The Prime Minister: I am afraid not. I do not think it is really any use in conditions such as exist to-day. I am very sorry I have to give you such a negative answer, but it is not, if I may say so, a case of breaking any pledges, because I thought about all this at the election, and I did not feel that I could give any. If you had any practical proposals on a smaller scale to put, I would be very glad to consider them.

Mr. German: I want to refer to the Committee which Sir Theodore Chambers presided over, and of which Sir Francis Floud was a member, and congratulate him on the report they drew up; but I would also like to submit to your consideration that the rate of interest should have been put at a lower figure. Men can borrow to-day at less than the interest recommended. I do think the Cabinet and the Ministry of Agriculture, in bringing forward their bill, should seriously review the question of interest. I believe we are all agreed that the Report is a first-class Report.

The Prime Minister: That will be done, of course.

Sir Robert Sanders: Certainly.

Mr. Robbins: You are quite right, Mr. Prime Minister, in stating that only two things go to the root of the question. These other things are palliatives. They will be a welcome relief to a limited number of people, but you are perfectly right in your diagnosis of the situation. Only two things go to the heart of the problem.

The Prime Minister: I agree. Do you not agree that at the moment both are impossible?

Mr. Robbins: I cannot say; I am not in your position, Mr. Prime Minister.

Mr. Dallas: I hope the Government have not closed the door with reference to the Wages Board. Just as you are considering and exploring the whole situation with regard to, say, Sir Theodore Chambers's Report and the Report that is coming from the Committee of Enquiry, so we hope that the Wages Board will also be included in the general review. The question is surely not closed, while others remain open. I do not want you to pledge yourself in any way.

The Prime Minister: I think it is only fair to say that, so far as I understand it now, we cannot be of any help.

The deputation, having thanked the Prime Minister for having received them, withdrew.

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LINCOLN RED SHORTHORN CATTLE.

JOHN EVENS.

THE original cattle of Lincolnshire in their unimproved state were distinguished by their great size, but slow powers of fattening. About a hundred years ago their improvement was commenced by the introduction of the new type of Shorthorn which then arose in Durham and Northumberland. Three bulls were sent into Lincolnshire from Charles Colling's great sale in 1810. One of the most potent factors, however, in bringing Lincolnshire Shorthorns to their present type was the herd formed by Mr. Thomas Turnell, at Reasby, near Wragby, towards the close of the 18th century. Arthur Young, in his report to the Board of Agriculture upon Lincolnshire in 1799, says, "that Mr. Turnell has a breed of cattle which are not surpassed by any in the county for points highly valuable, or their disposition at any age to fatten rapidly. The breed originally came from the neighbourhood of Darlington." He then goes on to say that these cattle were of medium size, which he preferred to larger ones.

It is unfortunate that more minute records do not exist of the methods of breeding pursued by Mr. Turnell, but most of the best herds in the county at the present time acknowledge the influence of the "Turnell Reds." Mr. Turnell impressed his cattle with the deep cherry red colour now so much the fashion, and while slightly reducing their size from the original type, gave them greater powers of rapid fattening, and of developing the primest joints of meat.

A Dual-Purpose Breed.—The Lincoln Red Shorthorn is distinguished by length of frame, good constitution and great hardiness, capacity for milk, and great weight of carcass. The steers at 2½ years old may be expected to yield 7-8 cwt. of the best meat, and the young cows when finished milking will attain a similar weight. The females in certain herds produce after their first calf up to 4 gallons of milk per day, and as matured cows up to 6 gallons.

The tenant farmer to-day must exercise every possible economy. He cannot be too careful in the selection of cattle with which to stock his farm. He must turn to a class of cattle which he believes to be a real "rent payer." It used to be said "Booth for the Butcher and Bates for the pail," but it is claimed that the Lincoln Reds will do for both purposes.

The following are given as three illustrations: A heifer, "*Whitefoot 7th,*" won in a good mixed class at the Lincoln Christmas Fat Stock Show. Her sire's dam averaged over 1,000 gallons of milk after her five calves, and her mother's dam won first twice in open Royal Milking Trials.

Missy, after winning in a dairy class, won a second at a Christmas Fat Stock Show. Her sire weighed 28 cwt., and was from a cow that averaged over 900 gallons per year. Her dam averaged 1,210 gallons per calf after six calves.

Ruby 12th, a 1,000-gallon cow, won seven money prizes at London Dairy Shows, one of her daughters won three firsts at dairy shows, and another daughter was second in a good class at a fat stock show.

An animal to be successful must have constitution. Lincoln Reds are brought up on thrifty lines, mainly wintered in fold yards with little shelter, fed largely on barley straw and turnips, exposed to the wet, and the coldest of our east winds.

About the middle of April they are turned out to get their own living, facing the biting east winds from the North Sea, and if there is any delicacy in cow or calf it is soon found out. Such is the test that has been going on for over 100 years, and surely the result must be the survival of the fittest.

Herd Book.—Before the establishment of the Herd Book in 1895, several breeders had sent a few bulls abroad on their own private written pedigrees, but the time had quite rightly arrived when the foreign buyer required some recognised proof of breeding.

Records of the leading herds, though not entered in a Herd Book, had been kept in some cases for nearly 100 years, and the breed has generally conformed to one type and colour, as shown at the yearly sale of bulls at Lincoln April Fair. Freedom from the restraint of a paper pedigree increases the usefulness of a breed during its period of development, because it enables breeding animals to be selected for merit alone, and not because they spring from any particular line of blood.

In May, 1895, was issued the first Herd Book, containing about 100 members. To-day there are 500 members from all parts of England, and the census of pedigree stock recently published by the Ministry of Agriculture shows that this is the second largest breed of pedigree cattle in England, Shorthorns of course being first.

In the first Herd Book, herds were entered collectively. Bulls were always individually entered and numbered, and when the

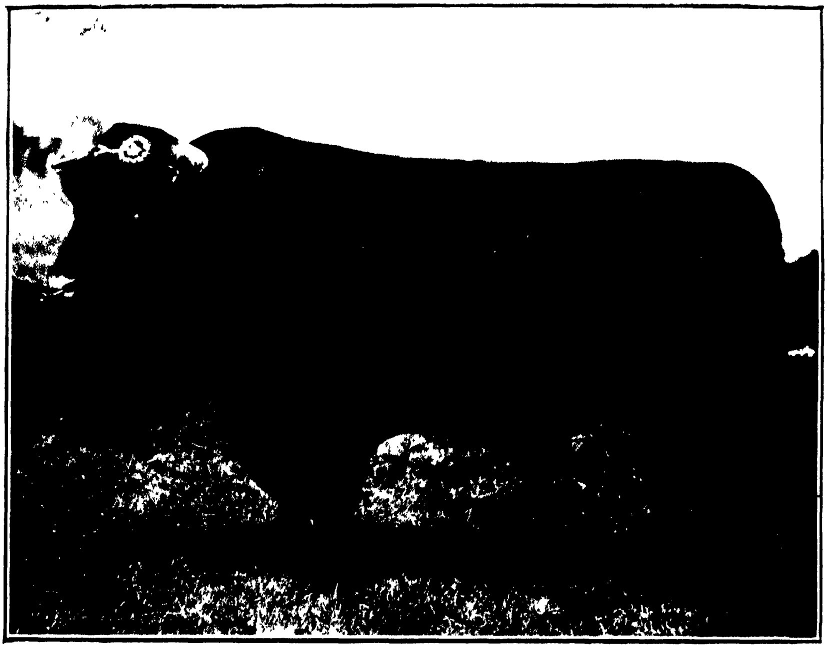

FIG. 1.—Lincoln Red Shorthorn Bull. Horkstownian Premier.

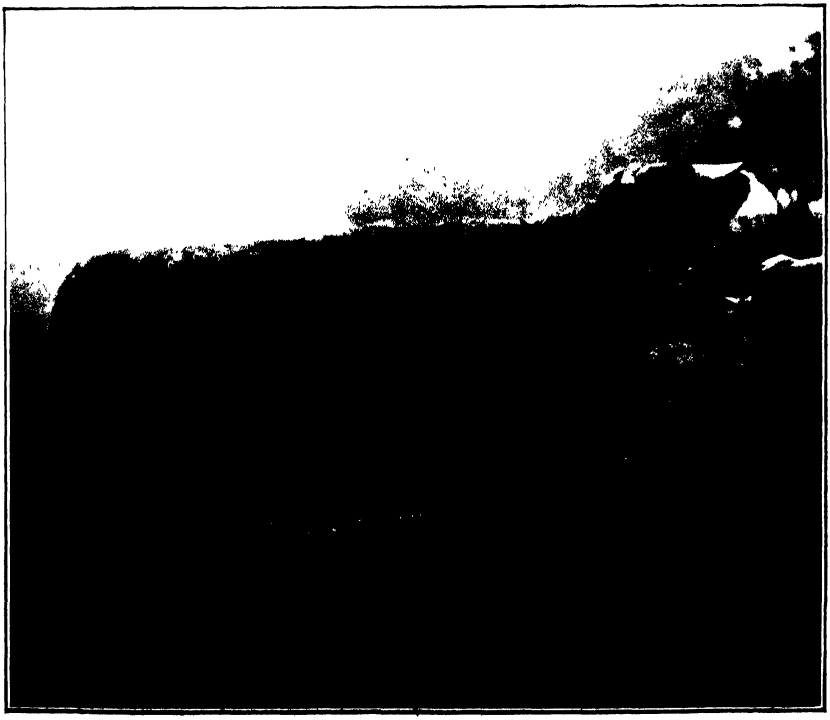

FIG. 2.—Lincoln Red Shorthorn Heifer. Saltfleet Red Rose.

Association was firmly established it was made compulsory to enter all females individually.

Being all red the cattle are wonderfully alike, especially as calves and yearlings, so they are all earmarked within a month of birth, on a plan adopted by the Association.

Sale of Bulls.—The annual show and sale in Lincoln during the Lincoln April Fair is probably unique in the history of cattle breeding. About 400 young red bulls, chiefly 12 to 16 months old, are sold in four hours, half of them going into distant counties of England. At the 27 annual sales 6,606 bulls sold have realised £247,872, an average of about £37 10s. each. During the last three years this one annual bull sale has realised over £60,000, or an average of over £20,000 a year, which has gone chiefly into the hands of the Lincolnshire farmers. This shows what an asset the breed is to the county.

During the last three years classes for Lincoln Reds have been included at the Smithfield Show. Unfortunately they have been badly supported, the explanation being that up to the last year or two practically all our herds have been owned by tenant farmers, for whom the expense and trouble of showing is too great.

Beef Production.—Most of the breeders practise rearing and fattening. The general custom is for the cows to calve in the spring and rear one or two calves out at grass, these being weaned in the autumn. The dams are then wintered cheaply on barley straw and turnips, the best of them being sold to go into town dairies at about the third calf. The young steers are kept nicely going on to make beef at about 2½ years old.

Dairying.—In order that buyers may know which are chiefly beef herds and which dairy herds, the Herd Book shows this year for the first time by an asterisk the names of those owners who are breeders of dairy cattle and members of milk recording societies. There are 58 of these.

Dairying is not much practised in Lincolnshire, owing to the dry climate, and the fact that it is a thinly populated county far from the large centres of consumption.

The Lincoln Red is nevertheless a breed that can hold its own in any company as a milk and butter producer, and still feed into a good carcass of beef when finished at the pail, breeding steers in the meantime that are good graziers and feeders.

Milk records for a herd of Lincoln Reds have been published for over thirty years—one of the longest series in the country.

The breed has a long list of successes in milk and butter tests all over the country. The British Dairy Farmers' Association's Journal, 1921, says, with regard to the London Dairy Show, "The Lincoln Red Heifer class was an exceptionally strong one; it is notable that the average milk yield of these heifers was slightly over 4 galls. per day, the highest yield for heifers in the Hall." Again the same Journal for 1922 says, "This class averaged more milk than any other class (heifer) in the Show; the quality was excellent." At the same Show the average of mature cows was as follows:—

	Average Milk Yield. lb.	*Fat.* per cent.	*Total Points.*
Lincoln Reds	60·93 ...	3·51 ...	123·19
Friesian	61·86 ...	3·35 ...	120·23
Non-pedigree Shorthorn	50·71 ...	4·05 ...	108·13
Pedigree Shorthorn ...	50·21 ...	3·98 ...	107·63

Perhaps the best win of the breed was last October, when Lord Bledisloe's Challenge Bowl (200 guineas) was awarded to the Lincoln Red Shorthorn Association for the best six all-round dairy cows exhibited at the London Dairy Show, 1922. This Cup is awarded to the six cows of any breed gaining the most points in milking trials and on inspection combined.

Export Trade.—Few animals have gone to South America, where the Shorthorn and the Hereford seem to hold the field. The largest numbers have been sent to South Africa, Chile and Brazil, where the whole-coloured dark red animals seem to be eminently suited to the hot climate as being less likely to attract ticks and flies. At the foot of the Matoppos, in Rhodesia, on the farm of the late Cecil Rhodes, the writer saw a wonderful object lesson a few years ago. About 50 or 60 sucking calves sired by Lincoln Red bulls were the produce of ordinary scrub cattle. These calves were bigger and heavier than their mothers; others had gone on well to the second and third cross. A Lincoln Red bull put to Africander cows, breeds a bull for which there is a good local demand.

* * * * * *

THE ENGLISH SUGAR BEET CROP.

CONTRACT CONDITIONS FOR GROWERS IN 1923 AND NOTES ON CULTIVATION.

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Agricultural Organiser for Nottingham.

Fifteen thousand acres of land will be under the sugar beet crop this year in the Midland and Eastern Counties, 9,000 acres being grown for the Cantley Factory, in Norfolk, and 6,000 acres for the Kelham Factory, near Newark. Some two thousand farmers have signed contracts for areas averaging 7½ acres. Thus it will be seen that the crop is slowly but surely making a place for itself in the rotation and is now looked upon as a practical business proposition.

The experience of growers during the last two seasons has been interesting, for it has confirmed in a very definite manner the results obtained in a good deal of the early experimental work in this country, and also certain facts relating to sugar content and crops as affected by seed per acre, cultivation, soil and climatic conditions.

Quantity of Seed per Acre.—In view of all the published advice and the definite instructions sent out by the factory authorities as to the quantity of seed required per acre, one would imagine there was no need for further comment in this direction. This, however, is far from being the case, and it is most important that growers should realise the necessity for using enough seed, as the sowing of too small a quantity has undoubtedly been responsible for numerous thin crops.

One finds over and over again that where a thin seeding has been used, only a 60 per cent. or 70 per cent. "plant" (or number of plants per acre), as compared with what should be the case, has resulted. This then is one direct channel where a loss of crop is experienced, and can very easily account for a diminished return per acre.

Trials to test the quantity of seed to sow, were carried out by the writer in 1912 on numerous farms in the Western and Eastern Counties of England. Plots were drilled at the rate of 12, 15, 18, 20, 25 and 30 lb. per acre. In 1912 the season was very wet, and in consequence 20 lb. of seed proved to be more than was necessary in the Western Counties, and crops that were singled late were difficult and costly to work. It was found, after allowing for possible difficult seasons and the probability that when grown commercially the distance between the rows would tend to get less, and also allowing for depredations by insects and other pests, that 15 lb. of seed per acre was a suitable quantity to sow on average soils and under average conditions.

It is interesting to note that under Clause 6 in the form of contract issued by the factory, it is laid down that 15 lb. of seed per acre shall be obtained from the Company at 6d. per lb. and that all seed supplied shall be used on the stated area. There are cases, *e.g.*, on strong land, where more seed should be used, and it is often in these very instances that it is difficult to get growers to appreciate the importance of this point. It is quite a common practice on the Continent to use 25 to 30 lb. of seed per acre, and yet one finds some farmers here who would try to use as low as 5 to 6 lb. A thin "plant" not only means a smaller crop in tons per acre, but it tends to reduce the sugar content of the beets and, of course, "gaps" mean "rubbish," so the grower loses on all counts.

Distance between Drill Rows.—Farmers are gradually learning that sugar beet, although allied to the mangold family, must not be treated exactly on the same lines, *e.g.*, the practice of drilling on the ridge with farmyard manure applied direct, is giving way to the more suitable method of applying dung in the autumn and ploughing in early, or even applying to the preceding crop, and drilling on the flat with a smaller distance between the rows.

Practical experience on a large scale has confirmed experimental evidence that wide drilling is responsible for a further reduction of possible crop, and it is very important that the drills should be as close as possible consistent with the soil and other conditions.

The roots of sugar beet are not generally large; the average will only weigh about 1½-2 lb. when topped; it will therefore be seen that closer rows will mean many thousands of extra plants per acre and a proportional increase of crop in weight and sugar. To be able to drill at 16 in. to 18 in. between the rows, it is necessary to have a horse hoe suitable for the work, and this fact has probably deterred some growers from altering the old practice of 24 in. and 30 in. work done for mangolds.

Many experiments have demonstrated that early and continuous hoeing when properly carried out is directly responsible for an increase in crop.

Rolling.—The very great value of using the roller to encourage early and even germination must not be lost sight of. By judicious rolling it is possible to overcome to a great extent the effects of a dry spell.

Hoeing.—Horse hoeing must be early, thorough, and continuous until it is no longer possible owing to the leaves closing up the rows. It is advisable to have an implement that will allow early hoeing, and keep the soil well up to the plants, yet without smothering the young seedlings. There are excellent light draught horse hoes of Continental, Canadian and American manufacture fitted with disc coulters for the first early hoeing and replaceable by duck foot and angle tines as required. These can be obtained through the factory authorities at a reasonable cost.

These horse hoes are capable of doing four rows at a time and are fitted with a driver's seat and a clever device for moving all the tines as required with ease, so that any irregularity of the rows can be allowed for. They are on the same principle as those used in most of the large sugar beet areas all over Europe, and are a type that might prove very useful for other purposes in this country. It is anticipated that similar hoes will be turned out by English makers before very long, even if there are not some on the market already.

Value of Early Singling.—Perhaps one of the most important points in connection with growing a successful sugar beet crop is that of early singling. It was one of the most difficult problems that confronted the writer in the early experimental days and remains so to this day. Large numbers of farmers have yet to learn the supreme importance of singling when the plants are really small.

Horse hoes should be started directly the plants can be seen in the row, and bunching or chopping out and singling as soon as the plants have formed four leaves, when they are but 1 to 1½ in. in height. Even then it is difficult in a good growing season to get the crop done before the plants have grown to such a height that it is difficult to do the work properly. It has been conclusively proved in carefully conducted experiments that late bunching and singling may reduce the crop by several tons per acre. Further, the work is more difficult and costly when done late.

Sugar Content.—The average amount of sugar in the beet crops of 1922 was 16½ per cent. Large numbers of beet crops, however, recorded 17 and 18 per cent., and as high as 19 and 20 per cent. was reached in a few cases.

For many years it was thought that the climatic conditions prevailing in this country would prevent the growing of sugar beet from becoming a commercial proposition. The averages obtained at the sugar factories have entirely dispelled any misgivings on the score of climate.

It has always been assumed that plenty of sunshine is essential to ensure a high sugar content in the root, but at the Kelham factory in 1921 the average sugar content for 25,000 tons of beet was 15.9 per cent., whereas in 1922 for the same quantity the average was 16.74 per cent.

Now it was generally thought that the hot summer of 1921 was ideal from the sugar content point of view, and as a matter of fact very high percentages were recorded when the beets started coming into the factory. It will be remembered, however, that rains set in during the early autumn, which started second growth in the crops and caused a most extraordinary drop in the crystallisable sugar. Beets from one farm were registering 18 per cent. but the same crops dropped to 16 per cent. before delivery was completed.

The season of 1922 was, as everyone knows, a very overcast and sunless one, and the crops grew longer. Conditions prevailed that were generally considered very unfavourable for sugar production, and yet the average sugar content came out to more than in 1921, thus confirming the early experiments showing that so far as climatic conditions are concerned sugar beet is a suitable crop to grow in the district covered by the factories.

Localities and Attitude of Farmers.—Large areas of sugar beet have been grown in the potato districts of Cambridgeshire and Lincolnshire, where farmers are used to intensive forms of cultivation and also to growing crops under contract. Farmers in these areas have been quick to recognise the fact that sugar beet is not only a paying crop, but that every acre of beet will probably mean an acre less under potatoes or other similar crop, thus directly assisting in regulating the supply and consequent market price for such crops. This effect is hardly noticeable at present, but if further factories are erected it may make a big difference.

A curious fact is that farmers who lived in close proximity to the factory were not nearly so keen to grow as those at a greater distance. Possibly the type of farming had something to do with it, but apparently the desire to take up contracts has been much keener this year, and, rather unfortunately, it has not been possible to accept the whole acreage offered, as those who grew before had a prior right to a similar acreage, and the factories can only deal with a given quantity of roots. As other factories are erected, the crop will probably become more and more a definite part of the rotation and the bulk will be grown nearer home. Already, however, there is a very decided change of attitude and farmers are realising that although there may not be a fortune in the sugar beet, it is a crop that has many advantages, *e.g.*, the market is certain and it is a ready money crop. It demands good cultivation, but leaves a residual value which is making a mark where the crop is grown.

The Principle of Co-operation.—Factories run on co-operative lines with farmers as shareholders are not uncommon on the Continent, and it is by no means improbable that the co-operative system may be introduced in this country. It is of more than passing interest to know that the principle is creeping in and is taking a very definite form this season.

When the Kelham factory was started in 1921 a flat rate per ton of washed and topped sugar beet at the factory was offered, *i.e.*, a price per ton net after the beets had been washed at the factory.

In 1922 there was offered a price per ton plus one shilling for each half per cent. of sugar over 15½ per cent. This was done partly to encourage men on light soils where smaller crops, but with a high sugar content, might be expected, and also to promote methods of good cultivation that would tend to increase the sugar in the roots.

For the season of 1923 the offer to farmers definitely makes the grower a participator with the factory in the ordinary trade risks. Under the contracts submitted for this season, the price to be paid for beet will be based on the net average price received by the factory for the sugar produced, while the variation for sugar content has been increased from 2s. to 2s. 6d. for each one per cent. of sugar content over 15½ per cent.

Contract Conditions.—The contract conditions for the 1923 crop are as follows:—

1. *Price.*—The price to growers for properly topped and washed beets (tare deducted) *delivered into the factory sidings or flumes* will be 40s. per net ton, subject to the following:—

(a) *Sugar Price.*—One shilling or a fraction thereof per net ton added for each one shilling or a fraction thereof of "the average sale price of sugar" (as hereinafter defined) per cwt. over 40s., and one shilling or a fraction thereof per net ton deducted for each one shilling or a fraction thereof of such price less than 40s.

(b) *Sugar Content.*—Two shillings and sixpence or a fraction thereof per net ton added for each one per cent. or a fraction thereof of sugar content over 15½ per cent., and two shillings and sixpence or a fraction thereof per net ton deducted for each one per cent. or a fraction thereof of such sugar content less than 15½ per cent.

2. *Freight.*—The Company will pay all rail or barge freight on behalf of the grower, and deduct the same from the grower's account. If not so deducted, such freight will be due and payable to the Company on demand.

3. *By-Products.*—The grower shall have the option of purchasing from the Company dried beet pulp to an amount equal in weight to 5 per cent. of the total net weight of beets delivered by him, at the price of £5 8s. *per ton ex factory, provided that such option is exercised in writing to the Company before the 1st August,* 1923, *and that the grower thereby undertakes to use upon his own farm the dried beet pulp so purchased.* If the grower has not exercised such option before the said date he shall not be entitled to purchase dried beet pulp manufactured by the Company except in the open market.

4. *Advances.*—The Company is prepared to make to growers who may desire to avail themselves of the opportunity and who make written application therefor, advances upon their crops before delivery not exceeding £5 per acre in all. No advance shall be made to a grower unless in the opinion of the Company the condition of his crop warrants it, and not more than £2 10s. shall be advanced before the crop is singled to the satisfaction of the Company, while the remaining amount shall not be advanced before 1st August, 1923. The amounts of such advances with interest at the rate of 5 per cent. per annum shall be deducted by the Company from the grower's account before making any payments in respect of beets delivered, and if not so deducted, shall be payable to the Company on demand.

Attention should be drawn to Clause I (*a*) which gives the improvement in price when sugar is more than 40s. per cwt., but also to the rate of deduction in the event of sugar being less than 40s. per cwt. As prices stand to-day, there is a good prospect of a considerable improvement on this basis price, but it should be clearly understood that in the event of any unforeseen circumstance causing a decided drop in the price of sugar, then proportionately there will be a fall in the price paid the farmer for this crop. A very ingenious table for calculating the price due to a grower is given on the back of the contract issued to each farmer.

The following figures are quoted as an example. Let us assume the price of sugar to be 49s. per cwt., and the average sugar content of beet 16½ per cent. A glance at the table shows that under these conditions a grower would receive 51s. 6d. per net ton of beet delivered to the factory. Should the price of sugar vary up or down, the farmer will proportionately lose or gain according to the defined scale.

In conclusion, the writer would like to record his appreciation of the help given him by Capt. J. N. Mowbray, Agricultural Officer for the Kelham Beet Sugar Factory, who kindly discussed the various points under consideration and made helpful suggestions.

* * * * * *

FATTENING PIGS OUT OF DOORS.

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So much has been written recently about open-air pig keeping that there seems to be a little danger of losing sight of some of the essential points in feeding practice.

Pigs are generally fattened for slaughter before they have attained full growth, and the food which they receive is utilised in the following directions:—

(1) Maintaining the vital functions of the body—digestion, blood circulation, etc.

(2) Providing material to repair the wear and tear of the animal's mechanism.

(3) Producing heat to maintain the animal's body at normal temperature.

(4) Providing the energy used up by the animal as it moves about.

(5) Providing various substances for "growth"—bone, muscle, etc.

(6) Providing the raw material from which the pig makes and stores the fat in its carcass.

Of all these directions in which the food is utilised, only 5 and 6 are productive, that is, they are the only parts of the food consumed which produce something of money value. The rest, from the farmer's point of view, represent waste, and though they cannot be done away with, it is to his interest that they should be reduced as low as possible.

As regards (3) and (4), it is clear that the amount of food required to maintain the heat of the animal's body and to provide it with the energy necessary for moving about is directly affected by the conditions under which the animals are kept. If they are exposed to cold, and particularly cold, *wet* conditions, the natural heat of the body can only be maintained by an increased diversion of food for this purpose. This applies to all animals, but particularly to the pig, which has very little protective body covering as compared with sheep or even cattle. Similarly, an animal more or less at rest uses up much less food than one which is continually moving about.

It is not so obvious that 1 and 2 are under the farmer's control, but to a certain extent they are. Generally speaking, the older an animal is, the more food is used for these " maintenance " purposes, and the waste (from the point of view of the farmer's pocket) involved by using food in these directions is reduced to a certain extent by fattening the animal at an early age, and avoiding what may be called a " store " period. From the point of view of food economy, it is therefore clear that the sound policy in fattening pigs is (*a*) to keep them going from the start, as increase in weight is secured with a smaller consumption of food in young animals than in old, (*b*) to keep them indoors, or at any rate not exposed to inclement conditions, and (*c*) to keep them at rest as much as possible.

Other considerations have, however, to be taken into account. First of all, a certain amount of exercise is necessary to the health of any animal. Then experiments which have been conducted show that some foods commonly fed to pigs are deficient in certain accessory food constituents, termed " vitamines." These constituents are abundant in green food, and pigs fed out of doors are not likely to suffer for lack of them, but it is possible that pigs fed always indoors might so suffer.

In view of the many different points to be taken into account, it seems desirable to ascertain as definitely as possible the importance of each. Naturally the various factors concerned have different degrees of importance in different classes of animals, *e.g.*, breeding sows, fattening pigs or young stores. The following notes describe an experiment with young fattening pigs.

Object and Plan of the Experiment.—As a preliminary to the investigation it was decided in the first place to test at the College Farm whether the greater exercise and the green food secured by outdoor pigs are of sufficient value to compensate for the waste of food involved by the increased exposure and movement. Further, the experiment afforded a chance of ascertaining whether young pigs fed on an ordinary mixed ration of meals are likely to suffer from lack of vitamines. Two litters of pigs, 22 in all, were divided when weaned at eight weeks old into two equal lots, half of each litter being put into each lot. The pigs were all sired by the same Large Black boar, and the two dams were closely related pedigree Large Whites. The sows had been sty-fed but ran out for a short time daily in a small grass paddock. Up to the time of weaning, none of the young pigs had been allowed out of the sty.

After weaning and the division into two lots of eleven each, Lot I was placed in a part of the stackyard, about 40 yards square, fenced off for the purpose. A considerable area of this was covered with grass, and in addition there was in parts the usual miscellaneous herbage found in stackyards, including weeds of all kinds, " volunteer " corn, and in one part a fair number of young potato plants growing among the debris of potato clamps which had been situated there in the previous winter. For shelter, a corrugated semi-circular steel shelter, open at one end, was provided, but except in wet weather this was rarely used, the pigs generally settling for the night under the lee of a small hay stack situated in the enclosure. This provided another source of food for the pigs, if they had cared to use it, though they were never observed to pull out any of the hay.

Lot II was kept entirely in a small sty of the common lean-to type with a small open court attached. This had a brick floor, and great care was taken to prevent the pigs securing green food, or any material whatever beyond the rations given below.

Both lots received exactly the same meal rations, and the only difference between the two lots was that the pigs in Lot I were kept in the open, and had plenty of exercise and a considerable variety of green food in addition to the allowance of meals. The area at their disposal was, of course, not large, but at no time was the enclosure eaten down so bare that they had any difficulty in securing green food. The food given was roughly adjusted in quantity to what the pigs would clean up readily, It was carefully weighed, and there was no obvious difference between the appetites of the two lots.

Rations.—At the commencement of the experiment the pigs, which averaged 45.7 lb. live weight, were receiving 2.2 lb. of meal per day. On 2nd October, when they averaged 198 lb. live weight, they were receiving 6.7 lb. per day. For the first two months the composition of the mixture of meal was as follows :—

Thirds (coarse middlings)	15 parts.
Decorticated Earthnut Cake	3 „
Fish meal...	2 „

The fish meal was reduced after the second month of the experiment to 1 part in 19 for the third month, after which it was discontinued altogether. The proportion of earthnut cake to thirds was 1 to 5 right through the experiment.

Raw potatoes at the rate of 2 lb. per head per day were introduced into the ration at the end of August, and continued for ten days. The amount of meal was reduced while potatoes were being fed, the basis taken being the assumption that 4 lb. of potatoes would be about equivalent to 1 lb. of meal.

The pigs were fed three times daily, the food being mixed with water and given in the form of a slop. The earthnut cake was soaked in water for a day or so in advance. It absorbed water readily and after a few hours could easily be stirred into a paste and mixed with the other foods. The thirds and fish meal were also mixed with water a short time before feeding, but separately from the earthnut cake.

The composition and prices of the foods used are given below. The decorticated earthnut cake used was of very high quality, and was in the condition of flakes, very suitable for the purpose. For the first week after weaning the pigs were given a little dried milk in addition to the food mentioned above, a total of 12 lb. being fed to each lot.

	Thirds.	*Decorticated Earthnut Cak*	*Fish Meal.*
	per cent.	per cent.	per cent.
Moisture	12·8	9·4	12·3
Ash	3·5	4·4	27·3
Albuminoids	16·6	45·1	57·4
Fat	3·4	15·0	2·0
Carbohydrates	58·2	24·0	1·0
Fibre	5·5	2·1	Nil
	100·0	100 0	100·0
Price per ton delivered at Aber Station	£9 5s.	£14 5s.	£22

The pigs were weighed at intervals as shown in the table on p. 31, which also gives the average daily increase, and the average daily ration per head.

Summary.—The results may be summarised as follows :—

	Period of Experiment June 12–October 2, 1922.	*Average total increase in live weight.*	*Average daily increase per pig.*	*Total weight of meal consumed per pig.*	*Weight of meal to produce 1 lb. live weight increase.*
Lot I.	days.	lb.	lb.	lb.	lb.
Indoor Pigs ...	112	153·14	1·37	499	3·26
Lot II.					
Outdoor Pigs...	112	151·55	1·35	499	3·29

Period.	Average ration of meal at middle of each period.		Average increase per pig per day for same period.	
	Lot I. Outdoor.	Lot II. Indoor.	Lot I. Outdoor.	Lot II. Indoor.
	lb.	lb.	lb.	lb.
June 12–June 27, 15 days ...	2·6	2·6	0·95	0·93
June 27–July 9, 12 days ...	3·0	3·0	1·12	1·36
July 9–July 24, 15 days ...	3·7	3·7	1·10	1·33
July 24–Aug. 8, 15 days ...	4·6	4·6	1·98	1·60
Aug. 8–Aug. 22, 14 days ...	5·0	5·0	1·58	1·44
Aug. 22–Sept. 4, 13 days ...	5·6	5·6	1·55	1·75
Sept. 4–Sept. 18, 14 days ...	5·8	5·8	0·90	1·43
Sept. 18–Sept. 25, 7 days ...	6·2	6·2	1·49	0·91
Sept. 25–Oct. 2, 7 days ...	6·5	6·5	1·71	1·36

Discussion of Results.—It is obvious that both lots of pigs made very satisfactory increases, and the amount of food (about 3¼ lb.) required to produce 1 lb. of live weight increase is well below the average. This is doubtless largely due to the fact that the pigs themselves were of a very good type. The first cross between the Large Black and the Large White is a very useful commercial pig.

Considered from a financial point of view the results were also very satisfactory. Shortly after the end of the experiment all the pigs were sold at 9d. per lb. live weight, and the cost of the food per lb. of live weight increase was hardly 4d.

Probable Error of the Results.—In considering the results of experiments such as these, it is necessary before attaching importance to any difference between the lots to remember that any lot of animals, treated in absolutely the same way, would show a certain amount of variation in results. By weighing each animal separately right through the experiment it is possible by calculations, which need not be described here, to ascertain the amount of this unavoidable variation. In this experiment the pigs were so weighed, and the "probable error" calculated. It was found to be in the case of the indoor lot ± 2·25 lb. and in the case of the outdoor lot ± 2·07 lb. Roughly translated into ordinary language, this means that no importance can be attached to any difference of less than 5 lb. between the average live weight increase of the two lots. As the actual difference between the average live weight increase of the two lots was only about 1¼ lb., the two lots may be considered as having put on identical increases. The low probable error in the experiments here discussed was probably due to the fact that the pigs were all of such similar breeding, and that progress in every case was steady from birth.

General Conclusions.—The results clearly show that the indoor lot did at least as well as the outdoor lot in spite of the fact that the latter had, in addition to the common ration, a small but not unimportant quantity of food in the form of grass and other herbage.

The appearance of the pigs throughout the experiment fully confirmed this result. The indoor lot looked particularly well right through the experiment. Their skins were clean and sleek, and they had every appearance of thriving animals. The outdoor pigs did not look nearly so well, their skins were rougher, and actually they looked worse than they really were. The indoor pigs led as regards weight throughout the experiment.

The results point clearly to the following conclusions:—

(1) The indoor lot of pigs did not suffer from any lack of "vitamines," and as their ration was probably less varied than ordinary farm feeding, there must be much less danger of pigs suffering from lack of "vitamines" than is often suggested. This confirms results recently described by Dr. Crowther in Bulletin No. III published by the Research Department of the Olympia Agricultural Company, Ltd.

(2) The extra energy used by the outdoor pigs in ranging about dissipated all the extra food material obtained in their green ration, and counterbalanced any special value which the exercise and green food may have had. Possibly part of this was used in providing the greater amount of heat required to maintain the body temperature, but as the experiment was confined to the summer months, the difference between the outdoor and the indoor pigs could not be particularly great in this respect. Had the experiment been continued through the winter it is only reasonable to suppose that this last factor would have played a more important part.

Labour and Manure.—The questions of labour and manure have not been touched upon. In the experiment described, the labour in preparing the food and feeding the two lots was exactly the same. The indoor lot required additional labour in that the sty had to be cleaned out daily. Against this, however, must be set the cost of fencing and ringing the outdoor pigs. As regards the value of the manure it might be claimed that in the case of the outdoor lot the manure was applied directly to the land, and no waste would result such as is inevitable in storing manure under any conditions. On farms in North Wales at any rate no particular value can be set on this because the manure is more required by the arable land than by the pasture.

This preliminary experiment only deals with one aspect of outdoor pig keeping, but it will have served its purpose if it has demonstrated the above conclusions to those who might be led to suppose that unlimited exercise and exposure to all kinds of weather are good in themselves, and that something more than an ordinary mixed farm ration is necessary to provide the "vitamines" required by young pigs.

* * * * *

WHITE CLOVER.

PROFESSOR R. G. STAPLEDON, *M.A.*,
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WHITE CLOVER (*Trifolium repens*) was first cultivated as a seed crop in Holland, and it is often spoken of as Dutch clover. It is indigenous throughout temperate Europe; and in Britain occurs as a wild plant far more abundantly and on a greater variety of soils than does red clover. It is an important and abundant constituent of the best old grasslands of the country; on the famous fatting pastures of Leicestershire, in the Blackmore Vale and elsewhere it often contributes as much as 25 per cent. to 35 per cent. of the herbage. It is also to be found on poorer classes of pasture, occurring both near the sea and on certain types of hill grazing. It is probably not too much to say that under proper manurial treatment there is hardly a soil in Britain that cannot be made to carry white clover.

Description of the Plant (*see Plate*).—White clover is generally a fairly, sometimes a very long-lived perennial. It has a well-developed tap root, but is otherwise shallow-rooted. It differs fundamentally from red and Alsike clovers in having solid stems which creep on the surface of the ground and which root freely so that single plants are able to colonize areas a foot, or in extreme cases a yard, in diameter.

White clover does not, therefore, produce the same abundance of top growth as red and Alsike, and, when cut, the hay consists mainly of flower stalks and leaves. The flower heads, which are smaller than those of red and Alsike clover, are produced on long stems and are white or pinkish.

A considerable number of forms of White clover are to be met with; these do not differ from each other in well-marked characteristics. From an agricultural point of view it is important to make the following classification:—

1. Indigenous or Wild White clover.
2. Ordinary White or Dutch clover of commerce—
    (a) grown for seed in England.
    (b) ,, ,, abroad.
3. Ladino: "Giant" or "Mammoth" White clover.

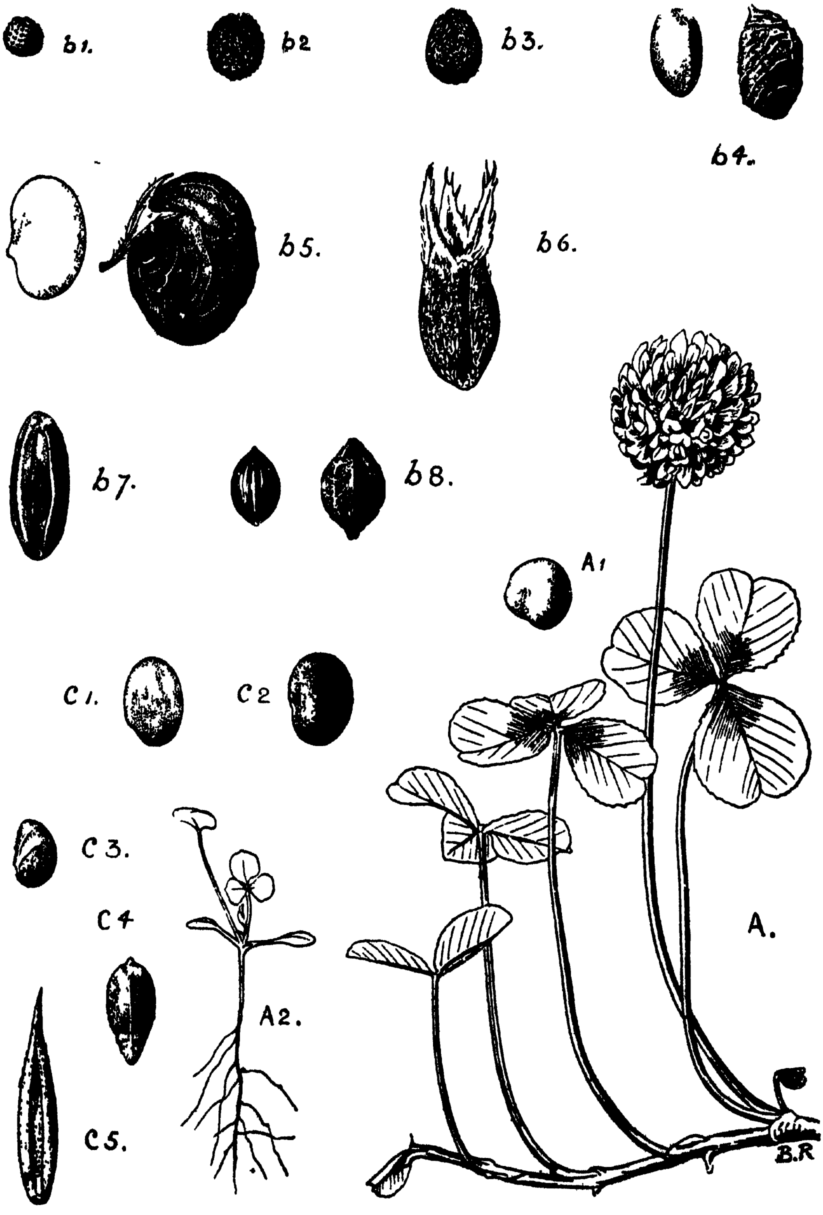
1. *Indigenous or Wild White Clover.*—Wild. White differs in no fundamental morphological characteristics from white Dutch clover. The plant is, however, a much longer-lived and more hardy perennial, with a more densely creeping habit, producing numerous long runners and a dense carpet of small leaves; its flower heads are often smaller and its seeds usually smaller than those of white Dutch.

2. *Commercial White Dutch Clover.*—White Dutch clover is grown for seed in Central Europe, Russia, Holland, Britain, New Zealand and America.

Much of the commercial seed does not give rise to a long-lived plant; indeed, white Dutch frequently only produces plants of biennial duration. There is evidence for thinking, however, that English grown white Dutch clover sometimes gives rise to fairly long-lived plants; this seems especially to be the case when the seed has been harvested from leys which have been down for more than four years. The probable reason is that on such leys a certain amount of Wild White clover is likely to have established itself unsown on the sward, and to have contributed to the seed harvest. New Zealand white clover also is said to give rise frequently to plants of considerable permanence strongly resembling the plants of Wild White clover in habit. It is not at all unlikely that this is so, since in New Zealand the seed is often harvested from leys of considerable age.

3. *Ladino: Giant or Mammoth White Clover.*—This clover is cultivated under irrigation in Lombardy, and in this country is sometimes put on the market as Mammoth White clover. Under suitable conditions it grows to almost twice the size of white Dutch, but is probably not a valuable plant under our climatic conditions. It is not so resistant to cold as ordinary white clover, and trials have shown that it frequently does not come through the winter well in this country.

Description of the Seed and Impurities (*see Plate*).—The seed of wild white clover does not differ from that of white Dutch in any absolute character. It is, however, usually smaller, and samples often contain more "hard" seed. The seeds of white clover are similar in shape to those of Alsike, but they are generally very slightly smaller. The colour is, however, different, for the seeds of White clover are pale yellow to pale brown. Good samples should have a fairly bright appearance; in badly harvested or old samples the colour becomes a dull uniform reddish brown.



WHITE CLOVER (*Trifolium repens*, L.)

A. In flower (nat. size), A1. Seed (x 8); A2. Seedling (nat. size).

b1. Mouse-ear Chickweed (*Cerastium vulgatum*, L.)
b2. Chickweed (*Stellaria media*, L.)
b3. Lesser Stitchwort (*Stellaria graminea*, L.)
b4. Dove's Foot Cranesbill (*Geranium moll*, L.)
b5. Trefoil (*Medicago Lupulina*, L.)
b6. Field Madder (*Sherardia arvensis*, L.)
b7. Ribwort Plantain (*Plantago lanceolata*, L.)
b8. Sheep Sorrel (*Rumex Acetosella*, L.)
C1. Yellow Suckling Clover (*Trifolium dubium*, Sibth.)
C2. Bird's Foot Trefoil (*Lotus corniculatus*, L.)
C3. Cinquefoil (*Potentilla reptans*, L.)
C4. Wood Rush (*Luzula campestris*, Br.)
C5. Crested Dogstail (*Cynosurus cristatus*, L.)

White clover usually contains rather a higher percentage of hard seed than do other clovers. Hard seed is seed which does not take up water readily and may therefore not germinate until a considerable time after sowing. Samples of wild white clover tend to contain considerably more hard seed than commercial white Dutch; this seed is unlikely to germinate in the soil during the sowing season, April-August, but after being subjected to frost and thaw during the succeeding winter much or most of it will germinate in the following spring. It may then, however, be too late for the seedlings to be able to establish themselves in competition with the other plants which will have largely covered the ground. It is therefore evident that samples of wild white clover containing 20 per cent. and upwards of hard seed are not satisfactory even for including in long duration mixtures.

The impurities met with in wild white clover and commercial white Dutch clover are decidedly different except when the wild seed is "once grown" under arable conditions, when the impurities are naturally much the same in both cases. The chief impurities met with in ordinary commercial white Dutch clover are very similar to those found in Alsike, the following being the most important:—Soft Cranesbill (*Geranium molle* and *G. pusillum*); Sheep's Sorrel (*Rumex Acetosella*), particularly abundant in samples from Central Europe; Madder (*Sherardia arvensis*); Yellow Suckling clover (*Trifolium minus*, Relh., *T. dubium*, Sibth.); and Trefoil (*Medicago lupulina*).

Dodder is a fairly frequent impurity in white clover from Central Europe, but is seldom or never met with in English or New Zealand samples. Wild white clover is likely to contain the seeds of plants normally associated with permanent pastures such as :—Yellow Suckling clover, Birdsfoot Trefoil, Crested Dogstail, Bent (*Agrostis*, spp.), Wood-rush (*Luzula*, spp.), and Sedges (*Carex*, spp.).

Yellow suckling clover sometimes contributes upwards of 50 per cent. to samples of wild white clover; this should always be guarded against when purchasing such an expensive seed as wild white clover.

Agricultural Uses.—Broadly speaking the ordinary commercial white Dutch clover should only be used in rotations, or as a component in mixtures for leys of not more than two or three years' duration, whilst wild white should in all cases be the white clover used for mixtures for leys of longer duration and for permanent seeding: indeed, it is often best to use the wild form even for two or three-year leys.

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* Hard seed detracts even more from the value of samples of red clover than of wild white clover, since the former is more generally used in rotations, so that if the seed does not germinate in the spring it will be of no value at all. Over 10 per cent. of hard seed is, however, the exception in red clover.

White Dutch clover is often sown in fairly large amount with perennial rye grass to afford sheep grazing for one or two years; about 5 to 8 lb. per acre of the commercial white Dutch seed is employed for the purpose.

It must be remembered that both commercial white Dutch and wild white clovers are valuable not only for the actual grazing they afford, but also because, with their rapidly spreading growth they tend from the outset to compete with weeds. Further, on account of the abundance of nitrogen-collecting nodules on their roots (especially in the case of wild white clover), they do much to enhance the fertility of the land. Red and Alsike clovers are valuable for the same reason, but since White clover lasts longer and spreads freely throughout the sward its influence on fertility is probably greater than that of the larger clovers.

It is therefore important from the point of view of keeping out weeds that White clover should be quickly established, and from the point of view of fertility that there should be an abundance of White clover in the sward when it is again ploughed. In the case of a one- or two-year ley the cheaper commercial white Dutch clover may often be relied upon to fulfil both functions, but it cannot be depended upon to persist in large amounts into a third year. For three-year leys it would be most satisfactory to sow about 2 lb. of wild white without any white Dutch clover. It is, however, not an uncommon practice to include about ½ lb. per acre of wild white with 2 lb. of white Dutch in mixtures for such leys. There is, however, a considerable risk of the quicker growing white Dutch clover seriously interfering with the development of the wild white. Unfortunately the supply of wild white clover available remains inadequate and the cost of the seed continues to be excessive. This is to be the more regretted since there can be no doubt that it would be advantageous to employ the seed in short duration mixtures: it is a great mistake to regard wild white clover seed as being suitable only for permanent mixtures.

Long Duration Leys and Permanent Mixtures.—The inclusion of wild white clover in all mixtures for three years and upwards is strongly to be recommended; it ensures a good and lasting clover sward, and materially assists in keeping down weeds. It is true that on certain soils and under the influence of phosphatic manures, the indigenous plant may establish itself abundantly by about the fourth year even without being sown and so ensure final fertility, but in this case it will not have achieved the earlier effect of suppressing weeds.

Numerous trials have now proved that it is seldom necessary to include large amounts of wild white clover in long-duration leys and permanent mixtures, but that all the benefits will usually result from including from ¼ to ½ lb. per acre of this expensive seed in such mixtures—1 lb. probably in all cases being ample.

In this connection it should be remarked that seeds mixtures for long leys and permanent grass are often, if not usually, unduly complicated, so that by dropping a number of species of very doubtful value, 1 lb. or even more per acre of wild white clover might be employed without adding materially to the price per acre of the mixture as a whole.

If wild white clover at a high price is employed in seeds mixtures, it is very desirable to take precautions to ensure a good take, and to safeguard the development of the plants. Wild white clover may never establish itself if a corn crop is badly lodged on the "seeds," and even if the plants have established themselves they may subsequently be killed if a very heavy hay crop is allowed to develop in the first year. Wild white in a seeds mixture should therefore always be sown under a stiff strawed cereal or under rape, or without any nurse crop, and if hay is taken in the first year it should be cut early.

Growing Wild White Clover for Seed.—Information as to the growing of Wild White clover for seed will be found in Leaflet No. 355.

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PREVALENCE OF DODDER IN GREAT BRITAIN.

THERE is no doubt that dodder, once it has become established, is one of the most harmful weed pests with which the farmer has to contend, and it is very important that it should not be allowed to gain a footing on clean farms. There are some eighty species of dodder known to science, several of which occur in this country. The species most frequently met with, however, is *Cuscuta Trifolii*, Bab., which chiefly attacks red clover and lucerne. It may be readily recognised by its red creeping stems smothering the host plant.

In most countries where laws are in operation for the purpose of checking the distribution of noxious weeds the sale of seed containing specified proportions of dodder is prohibited. Under the Seeds Act, 1920, it is necessary in this country for the presence of dodder to be declared if it is present in a parcel of seed to the extent of more than one dodder seed in 1 oz. of wild white clover; or in 2 oz. of alsike clover, white clover or timothy; or in 4 oz. of red clover, crimson clover, flax seed, linseed or lucerne. In some other countries the regulations governing the sale of dodder-infested seed are much more stringent. For instance the importation into France of any forage seed containing dodder is absolutely prohibited.

Prevalence in Different Districts.—The growth of dodder is affected by climatic conditions. It has, for example, rarely if ever been known to become established in Scotland and the presence of dodder in seed sown in Scotland is regarded as of no greater importance than the presence of relatively innocuous weeds. Farmers in Scotland can therefore utilise, without danger, clover seed, etc., which, owing to the presence of dodder, might be unsuitable for sowing in warmer climates. For this reason the Board of Agriculture for Scotland recently issued a general licence which renders it unnecessary for sellers of grasses, clovers, flax seed or linseed to make a statement in the terms of the Seeds (Scotland) Regulations, 1922, made under the Seeds Act, 1920, as to the presence of dodder, unless this information is specifically demanded by the buyer, and provided the purchaser resides or carries on business in Scotland and not in England, Wales or Ireland.

With a view of eliciting further information as to what extent dodder is in fact an established pest in England and Wales, an exhaustive inquiry was recently made by the Ministry of Agriculture, by ascertaining the opinions of the various County Agricultural Officers, numerous representative farmers, seedsmen, officials of agricultural colleges, etc.

From this inquiry it would appear that in Northumberland, Durham, Cumberland, Lancashire and Cheshire dodder is practically non-existent. It occurred in 1921 in the south of county Durham, but not to a harmful extent, and the fact that the dodder plants made good progress in this case was probably due to the exceptional season.

In the counties of York, Derby, Nottingham, Leicester, Lincoln and Rutland dodder is rarely seen, although a case is mentioned in Yorkshire where a crop of imported flax seed was practically ruined by the parasite, and another in which a crop of single-cut cow-grass was seriously damaged by a 2 per cent. mixture of dodder added experimentally. In the latter case the winter frosts destroyed the dodder, but the clover plants were left in an enfeebled condition.

In another Yorkshire experiment, in which clover seed with a large percentage of dodder was sown in 1921, the effect was a rather serious check on the crop in the first year, but in the following year the clover crop had recovered and was good and healthy.

The pest seems to be more prevalent in the Southern and Eastern Counties. It is reported as serious in East Suffolk and fairly common in Northampton. In Kent it was a source of trouble on 3 or 4 farms during the past summer, but not prevalent in the county as a whole. In Essex the freedom from dodder is attributed to the sowing of superior seed. It is not a serious pest in East Sussex although several cases have occurred.

In the southern counties from Hampshire to Cornwall it does not now appear to be present to any harmful extent, although it was a serious pest a few years ago, when it was not unusual for entire crops to be lost owing to dodder infection. The same applies to Wales and to Staffordshire, Shropshire, Worcestershire, Warwickshire, Gloucestershire and Herefordshire, except that it seems to give some trouble in the south of the latter county and in Warwickshire.

Effect of the Regulations.—Judging from these reports it would appear that dodder is not a matter of much concern north of the Trent although it is necessary, even in the north of England, to be careful when sowing cheap foreign clover seed. Seedsmen are obviously alive to the desirability of excluding dodder, but it is suggested that the same care in cleaning imported clover seed would not be exercised if it were not for the fact that under the Seeds Act it is necessary to declare the presence of dodder. One correspondent states "the fact that so little dodder occurs in this country is more likely due to the fact that the declaration required under the Seeds Act has resulted in samples of seeds being usually free from the pest, than that dodder is not serious when it does occur." Another correspondent in referring to the usefulness of the declaration as to dodder required under the Seeds Act says:—"I feel if it were removed it would be detrimental to the good class seed merchants who buy good pure samples on the market and would make an opening for that class of man who is not a *bonâ fide* seed merchant, but who sells mixtures to farmers on the market which are inferior and impure and the origin of which he knows little or nothing about."

It is interesting to note that in the north farmers call Mountain Flax or Spurrey (*Spergula arvensis*, L.), which is prevalent on poor sandy soils, where it is sometimes cultivated either for sheep food or silage, "dother" or "dodder."

Amount of Dodder in different varieties of Seed.—The experience of the English Official Seed Testing Station during last season was that clover samples on the whole contained rather more dodder than in the two previous seasons. This is probably due to the favourable ripening conditions experienced in this country during the hot summer of 1921. This is suggested because the increase is greater in the case of English grown seed than in foreign seed.

Apart from the slight increase noted last season the general experience of the Station is that the dodder content of clover seed is decreasing.

The following table shows the percentage of samples examined at the Station which contained dodder:—

RED CLOVER.

	All Samples	English	French	Czecho-Slovak	Chilian
1921—22	21·8	10·2	18·2	57·1	83·6
1920—21	19·2	4·4	13·4	83·7	82·6
1919—20	18·9	3·4	15·4	75·5	81·1
1918—19	27·3	12·1	36·6	—	90·9
1917—18	26·8	24·0	19·0	—	82·0

	ALSIKE.		WHITE CLOVER.		MIXED ALSIKE AND WHITE CLOVER.	LUCERNE.
	All Samples	Mid-European	All Samples	Mid-European		
1921—22	6·4	20·0	4·5	3·5	7·9	7·2
1920—21	5·5	38·9	3·4	12·5	16·1	12·3
1919—20	6·1	44·4	3·1	11·1	13·6	12·2
1918—19	Less than 1·0	—	1·3	—	Less than 1·0	6·7
1917—18	Less than 1·0	—	1·0			7·0

In view of the shortage of the English clover seed crop last year, it will be necessary this season to use a larger proportion than usual of foreign grown clover. Farmers should therefore exercise great care when purchasing supplies and should examine the statement as to the quality of the seed, which the seller must provide in accordance with the terms of the Seeds Act, to ascertain that all dodder has been cleaned out or that the dodder content is low.

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A TRIAL OF MOWING MACHINES.

II.

Mechanical Results.—Time and opportunity did not allow a complete investigation under this head. Nevertheless, the exacting conditions of the tests had the advantage of bringing to light certain minor weaknesses in the design and construction of the machines. It is probable that had the tests taken place on flat ground, very little difference would have been discernible in the quality of work done, and minor weaknesses would not have been revealed. An ideal tractor mowing attachment should embody the following features:—

(*a*) Ability to cut efficiently up to a speed of 3 m.p.h.

(*b*) The cutter bar should be sufficiently flexible to follow minor irregularities of surface.

(*c*) The lifting and tilting levers should be placed well within the reach of the tractor driver, and should not require great exertion to operate.

(*d*) Ample facilities for lubrication should be provided, which will also require the minimum amount of attention.

(*e*) Safety devices should be provided to stop automatically the forward movement of the tractor in the event of the cutter-bar meeting a serious obstruction.

(*f*) The pitman wheel should be either placed in such a position that it cannot become choked with grass, or else be protected by a cover.

The tests made it possible to examine some of the main faults of mowing machines. It is realised that the efficiency of horse mowers has improved very appreciably during the last few years, as shown by the fact that a pair of horses can now draw an 8-ft. machine, whereas several years ago a 3-ft. machine was all that could be used. The following observations may be of service to farmers in obtaining the best results from their machines.

Heavy Draught.—Heavy draught is caused by (1) poor lubrication, (2) a dull set of knives, or (3) non-alignment. The remedies for (1) and (2) are obvious, but the importance of (3) is frequently not appreciated.

The cutter-bar should work at right angles to the machine when actually cutting. The resistance of the grass frequently causes the bar to drop back a little, and consequently some manufacturers advise setting the end of the cutter-bar forward a distance of about 1½ in. With the cutter-bar working in this position the knife, connecting rod, and pitman wheel are in an approximately straight line. Should the outer end of the cutter-bar drop back and alter the alignment, increased friction is caused on the inside shoe parts. This friction produces increased draught but does not cause side draught as is often supposed. Non-alignment does not often occur in machines of under three or four years' service, and this points to the fact that non-alignment is caused by wear in the hinged joints between the cutter-bar and frame. The majority of mowers are provided with methods of adjusting the alignment of the cutter-bar. When making this adjustment, it is extremely desirable that great care should be taken to ensure that the adjustment does not prevent the knife sections from registering with the fingers.

Uneven Cutting and Side Draught.—Uneven cutting and side draught are due principally to poorly adjusted cutter-bars. It must be appreciated that the principle of the cutter-bar is the same as that of a pair of shears. If the two blades are held closely together a clean cut results, whereas if the blades are held loosely the material to be cut will wedge between the blades and will finally be pulled and not cut. If at the end or beginning of the thrust by the connecting rod the knife sections do not centre with the fingers, only a portion of the grass wedged between the fingers is cut. The remaining grass which is not cut but is pulled offers resistance against one side of the centre fingers, and is consequently the cause of side draught.

It will be seen therefore that the causes of uneven cutting and of side draught are (1) the knife section not being firmly pressed against the ledger plates, and (2) the knife sections not centreing with the fingers.

To correct (1) attention must be given to the guards, clips, and knife sections. If the guards are out of alignment the bent ones must either be straightened, or else replaced. Should the clips not be pressed firmly against the back of the knife, the clips should either be tapped down gently with a hammer or else replaced. Where both old and new knife blades are used, the clips should be adjusted for the new blades.

(2) One of the main reasons why on some machines accurate centreing does not take place, is that the drag-bar is sometimes altered in order to bring the cutter-bar more forward. This alters the position of the whole cutter-bar in relation to the knife. The remedy is to adjust the drag-bar. A second reason for non-registering lies in the use of a pitman connecting rod which is either too long or too short. This latter trouble is not likely to arise upon machines having iron connecting rods.

It is interesting to note that the 7-ft. International tractor mowing attachment worked with as little side draught as a 4 ft. 6 in.-machine. This tends to show that side draught is not so much a matter of width of cut as of properly adjusted parts.

Broken Knives.—Non-alignment and incorrect adjustment of clips and wearing plates are fertile causes of wear in the cutter. The plates and clips will under these conditions eventually wear sufficiently to allow of play in the knife as it is thrust in and out by the pitman rod; the knife is then subject to continual shaking and repeated bending at the head. This undesirable condition is the immediate cause of the breakage of the knives of which non-alignment may be said to be the primary cause. The risk of broken knives is considerably increased by a badly worn pitman box or crank wheel. Excessive wear in the plates, clips and pitman components can readily be detected by the familiar rattle when the mower is at work and should serve as a warning that renewals or adjustment are necessary if breakages are to be avoided.

Clogging of Cutter-Bar.—A loose or broken knife section may cause the cutter-bar to clog at one point of its length. The action of grass juice and excessive oil on the bar is liable to result in the formation of a heavy gum sufficiently thick to obstruct the action of the knife.

Bench Test.—A bench test was arranged in order to determine for each machine :—

(1) The efficiency of the knife components in cutting grass of measured gauge and moisture content.

(2) The factors in the construction of the cutter and its mode of attachment that make for efficiency of cutting.

The test was made in the following manner. A tractor was suspended from four corners with its driving wheels clear of the ground. The attachment worked with its cutter above a platform along which trays containing grass of known texture, density, and moisture were passed at varying speeds. The knife was driven at different speeds in each experiment with the different gears provided on the attachment. In this manner all the field conditions with the exception of the uneven ground were reproduced.

The experiments were repeated with the various machines available. Lack of time, however, prevented their being carried to an entirely satisfactory conclusion, and it will be necessary to resume the experiments at a later and more favourable opportunity in order to complete the data required. The particulars given in the accompanying table of mechanical details have been given purely as an example of the data so far collected and are not in themselves conclusive.

General Deductions.—Although circumstances prevented this test from being carried to a conclusion, there are certain general deductions which it is felt can safely be made at this stage. These conclusions are the result of visual observations on the occasion of the tests, but it may be confidently anticipated that they will find ample support from the data furnished by later and more detailed experiments.

There is little difference in the various cutters and their components. As regards the attachments as a whole, the principal difference noted was in the gear ratios used; from the table it will be seen that the pitman revolutions per minute at 2½ miles per hour, varied between 470 for the Cutmore to 770 for the Bentall.

Among the factors that require to be determined are the varying resistances offered by grasses of different types and varying moisture content, together with the most efficient cutting speed of the knife. As regards the resistances offered by different grasses, the data at present to hand do not justify any general conclusion, but there undoubtedly is a best knife speed for each texture of hay-grass. Variations of 10 revolutions per minute from this speed have no observable influence on the quality of cutting, and a marginal variation of possibly 50 revolutions per minute may be allowed within which cutting is still moderately good.

The scope of this investigation is not confined to knife speeds, travelling speeds and the nature of the material cut. The constructional details of the fingers, clips and blades require careful consideration. It was found, for example, that when the arches of the clips had only a small clearance heavy moisture in the crop was liable so seriously to resist the motion of the knife as to cause excessive strain on the pitman wheel. The most advantageous clearance may readily be calculated for a machine which is observed to work efficiently in a moist crop. This will serve as an illustration of one of the factors that may be determined by this investigation when it is completed.

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* In this *Journal* for March, 1923, p. 1093, it should have been stated that the Taco-Myers Tractor Mowing attachment is manufactured by the Tractor Appliance Company, New Holstein, Wisconsin, U.S.A. The British representative is Mr. E. H. Thompson, 58, Middlesborough Road, Coventry. The average price of this mowing attachment in 1922 was £35.

TABLE

COMPARATIVE PERFORMANCES AND COSTS.

Soil—Very heavy loam.
Crop—Generally poor.

Device	Power	No. of Men	Total Working Time		Total Acreage Cut	Average speed of cutting in m. p. hr.	Average Acreage Cut per Hour	Costs								Cost per Hour		Cost per Acre	
								Labour		Capital* Charges		Fuel		Total					
			hrs.	mins.				s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Albion	2 horses	1	8	37	6·4	1·2	0·75	5	5	16	2	—		21	7	2	6	3	4
Bentall (experimental) ...	Fordson Tractor	2	4	18	4·7	2·0	1·09	5	5	3	4	6	0	14	9	3	5	3	2
Bentall (two machines) ...	Fordson Tractor...	3	5	17	13·1	2·4	2·48	9	11	6	3	9	3	25	5	4	10	1	11
Tractor attachments																			
Cutmore	Fordson Tractor...	1	15	3	23·7	2·2	1·58	9	5	12	7	23	7	45	7	3	0	1	11
International	International Junior Tractor	1	6	3	7·3	1·4	1·21	3	9	5	5	9	8	18	8	3	1	2	7
Otwell	Fordson Tractor .	1	8	36	12·9	2·1	1·51	5	5	6	9	11	1	23	3	2	8	1	10
Taco-Myers	Fordson Tractor ..	1	11	15	17·0	2·1	1·51	7	0	10	11	25	2	43	1	3	10	2	6

* The capital charges include depreciation, repairs, and interest on capital. In the case of tractors the same figures have been taken for the two types used, as their respective working lives are not known.

TABLE II.

MECHANICAL DETAILS

Device	Travelling Speed in miles p.h.*	Pitman Wheel R.P.M.*	Average per cent.			Pitman R.P.M.			Forward movement of Tractor in inches to each revolution of the Pitman wheel
			Traction load in lb.†	Increase in loads					
				Gearing	Cutting	2 m.p.h.	2½ m.p.h.	3 m.p.h.	
Albion	1·67	500	—	—	—	600	750	900	3·5
Bentall (experimental) ...	1·38	420	536	10·6	11·6	610	760	910	3·5
Bentall	1·21	374	538	7·4	8·7	620	770	930	3·3
Bentall (two machines) ...	—	—	573	19·0	27·9	—	—	—	—
Cutmore‡	1·0	187	800	5·0	9·1	380	470	560	5·6
International	1·0	260	1,042	5·9	11·3	520	650	780	4·1
Otwell	·85	225	802	11·6	20·2	530	660	800	3·3
Taco-Myers	1·06	300	850	6·5	9·0	570	710	850	3·2

* Bench Test.

† The traction loads in the case of tractor mowing attachments includes the draught of the tractors.

‡ Two sprockets are supplied with this machine, one with 14 driven teeth and the other with 10 driven teeth. The larger one giving the slower knife speed was used for this test. The use of the smaller sprocket would have increased the knife speed by 40 per cent.

VIOLET FELT ROT RHIZOCTONIA) OF CLOVER.

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In mid-November of 1922 a field of red clover which was attacked by *Sclerotinia trifoliorum* causing stem-rot (clover sickness), was kept under close observation with the object of discovering whether any of the occasional plants of wild white clover amongst the red clover had suffered from the disease.

In the course of these observations, certain patches of the red clover were noticeable owing to their presenting an unhealthy appearance quite different from that characteristic of clover stem-rot (*Sclerotinia trifoliorum*). Examination of affected plants showed that they were attacked by a fungus, *Rhizoctonia violacea.* This fungus has already been described as attacking red clover on the Continent,* but so far as the writer knows, it has never been recorded as occurring on clover in this country. It is well known as causing serious injury to many other plants of economic importance and its attacks have been described by various authors from time to time on the following amongst other plants:—seakale,† carrots,‡ potatoes,§ saffron, lucerne, beet, asparagus, shallots, and madder. It has yet to be proved whether the fungus can pass readily from other host-species to clover, or whether specialized races or forms of the fungus exist.

Occurrence of the Disease.—The early winter of 1922 was mild with only occasional frosts. The disease was first observed at the end of November, 1922, but judging from the condition of the affected plants, it seems probable that the first appearance of the disease must have been some weeks earlier. Whether primary infection was aided by the mild conditions is unknown; it is possible that the frosts were responsible for the awakening or stirring into active growth of the dormant resting-bodies (*sclerotia*) of the fungus, which may have been in the soil.

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* Eriksson J., Fungoid Diseases of Agricultural Plants, 1912.

† Salmon, E. S., and Crompton, T. E. Report on Economic Mycology, South-Eastern Agric. College, Wye, 1908.

‡ Van der Lek, H. A. A., Contribution à l'Étude du Rhizoctonia violacea. Extrait abrégé des Mededeelingen van de Rijks Hoogere Land, Tuin, en Boschbouwschool, XII, 1917.

§ Ministry of Agriculture and Fisheries. Collected Leaflets. Sectional Volume No. 3, 1921.

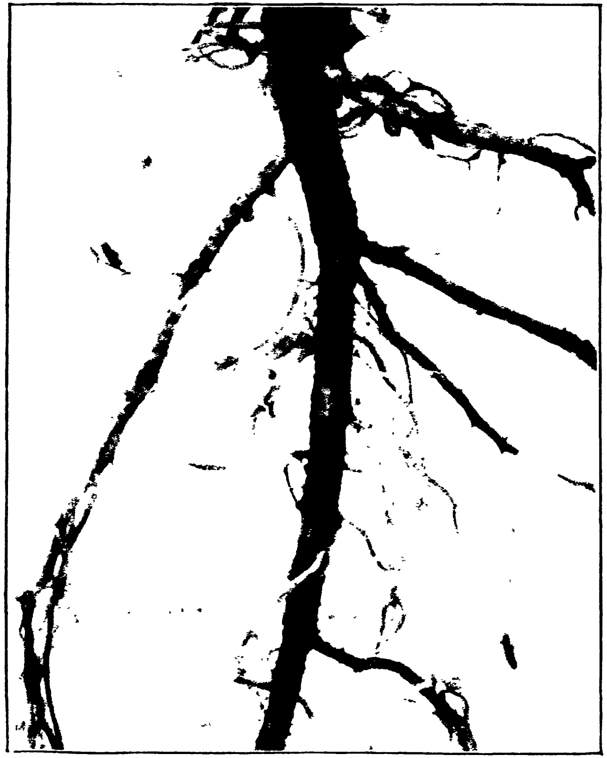

FIG. 1.—Part of a root of Red Clover showing numerous "sclerotia" of *Rhizoctonia*. (About twice natural size.)

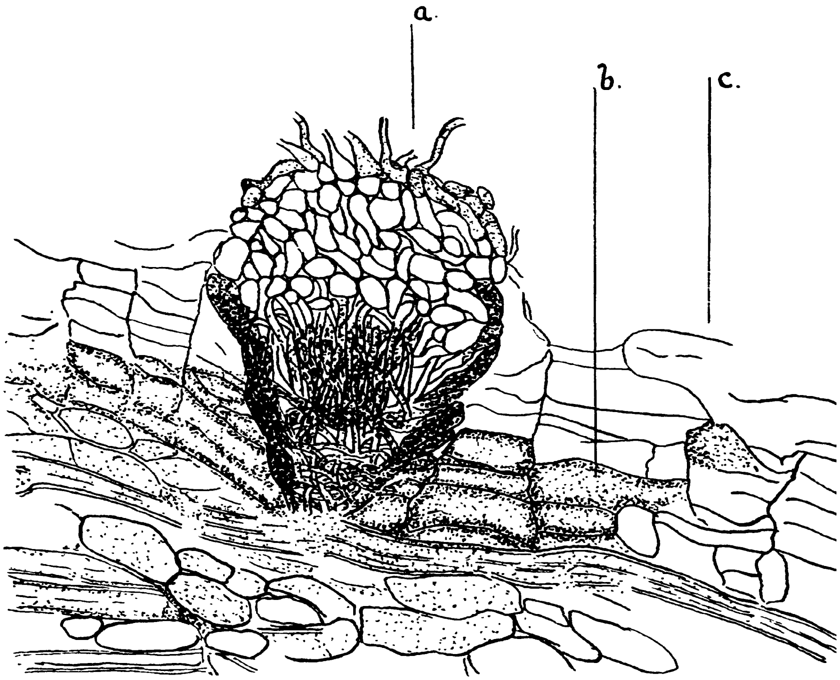

FIG. 2.—Part of a transverse section of a root similar to that shown in Fig. 1. A Sclerotium (***a***) consisting of fungus threads which have penetrated the cork cells of the root (***b***), (***c***), and have killed those shown at (***b***) (Greatly magnified.)

The fact that the fungus was found in an active state upon weeds and upon the stubble in the " seeds " causes a further complication in determining the means of original infection of the clover.

Although clover sickness was present in the same field, its attack was limited to certain areas and even to individual plants, and though occasionally the two diseases were found together in the same area, there were quite distinct patches suffering from the *Rhizoctonia* disease alone. It is thus quite evident that *Rhizoctonia* was present as a parasite on the clover, and was not merely saprophytic on plants or parts of plants previously killed by clover sickness. This was borne out by a close examination of diseased plants in various stages of attack.

Description of the Disease.—The vegetative part of the fungus has a compact, felt-like nature, and is found closely covering the substance upon which it is growing. It has a distinctly violet colour.

The presence of *Rhizoctonia* was first recognised on the brown, dead stubble of the previous oat crop in which the red clover had been sown. The violet-brown spawn covered the straw from soil level to a height of two and a half inches, and being fringed with white at its growing extremity, was particularly conspicuous. Close to such infected stubble, the clover plants were dwarfed and stunted, their outermost, larger leaves were either yellow, wilted, or dead, and the young shoots in the centre of the crown were stunted and somewhat limp. The appearance resembled that of clover attacked by eelworm, *Tylenchus dipsaci*, except that there was no swelling or malformation of the leaf stalks and shoots—a characteristic feature of eelworm attack.* Unhealthy coloration was evident, more especially in the young shoots in the centre of the crown, where stipules and leaf stalks were very commonly bright red. The leaf blades were pale green or yellowish. Many, though not all, of the plants affected, showed on closer examination, purple-brown mycelium, fringed with white, covering some of the lowermost stipules and shoots; this can be seen in Fig. 5.

Plants of red clover, dug up and carefully washed, revealed the violet-brown mycelium, in many cases, just above and below soil level. Oat stubble, similarly examined, showed the mycelium covering the straw below soil level and fragments of it were found penetrating the earth and covering solid objects such as stones and pieces of stick.

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* Described and illustrated by Arthur Amos, Jour. Royal Agric. Society of England, Vol. 79, 1918.

The attack is apparently carried out by the fungus with great vigour, and the entire root system of the clover plant is first destroyed in the following manner. The fungus threads penetrating the soil attack the main root and its branches and cover them with minute, twisted, brown strands. At numerous points the fungus penetrates the outer cork layers of the root, reaching as far as the cortex and at each place forming minute resting-bodies which possibly have also the function of suckers. These resting-bodies (*sclerotia*) can just be seen with the naked eye as small black dots, and are shown magnified in Fig 1.*

The layers of the root immediately in contact with these *sclerotia* become yellow or brown and are apparently killed; they are shown at B in Fig. 2. The fungus gathers strength and proceeds to envelop the root further until finally the whole root system becomes dark-coloured, soft, and rotten; it is at this stage that the above-ground parts of the clover present their most unhealthy appearance. In a few instances the whole of the above-ground parts were found enveloped in mycelium and killed; in many cases, however, the above-ground parts were not attacked, but the main root system was dark-coloured and studded with *sclerotia* (Fig. 1). In the majority of cases the plant (whether its stems are attacked or not) makes an effort to replace the loss of its main root system, and before this has completely rotted away, by adventitious roots developed from the base of the " crown." If these are forthcoming in time, the plant may be saved, and the effect of this renewal of the root system is immediately seen in the above-ground parts. Fig. 3 shows the useless main root system, dark-coloured, and now replaced by adventitious roots from the " crown."

The most critical period is when the main tap root has become rotten and the adventitious roots are just being formed; at this stage, plants can actually be picked up from the soil without any pulling effort since they are only provided with adventitious roots barely half-an-inch long.

Fig. 4 shows a healthy plant and one the root system of which is destroyed. This new adventitious root system becomes very strong and dense, and takes the place of the thick, woody tap root and its branches, as shown in Figs. 5 and 6.

The new root system was not found attacked by the fungus. It follows from the above that the plants killed are not

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* The author wishes to express his thanks to Dr. H. Wormald for the photograph reproduced in this figure.

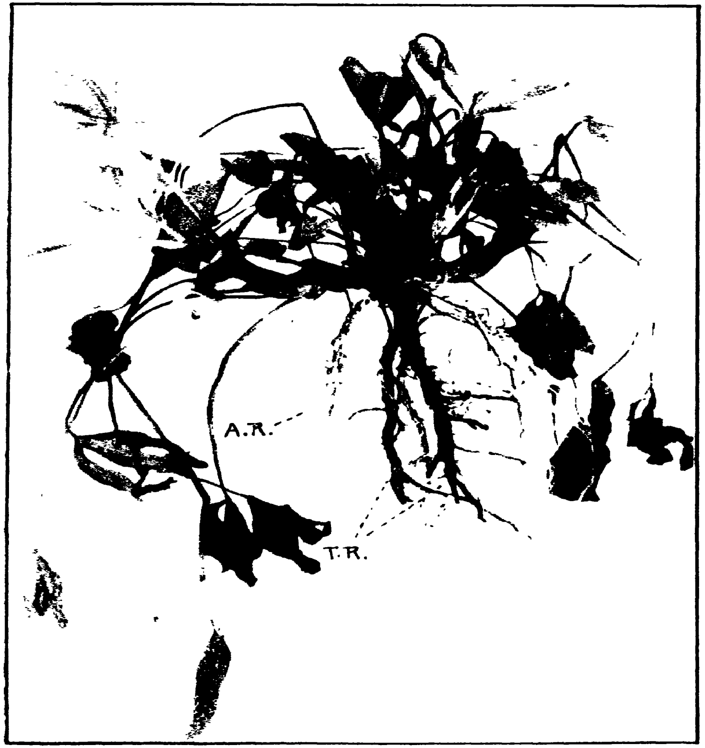

FIG. 3.—Red Clover plant showing Tap Root T.R., rotten and nearly useless, having been replaced by adventitious roots A.R. from the "crown."

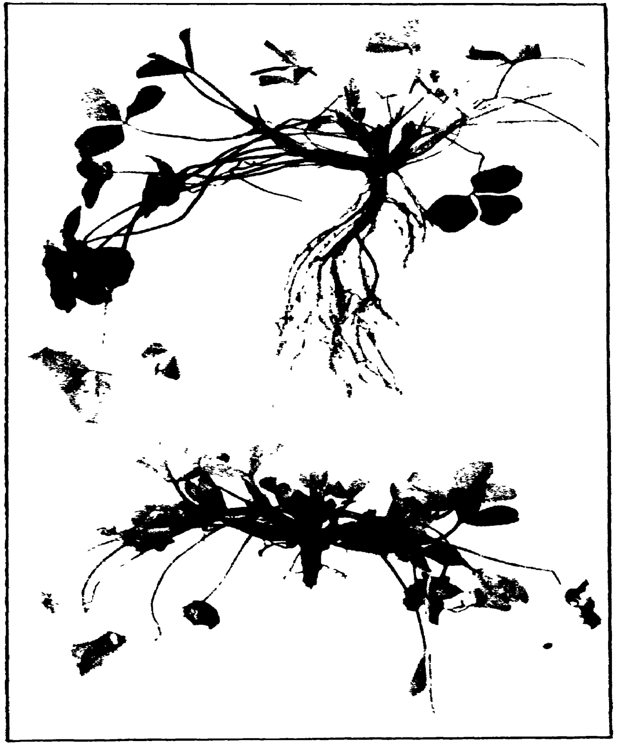

FIG. 4. Top, showing young healthy plant of Red Clover. Bottom, showing roots of plant totally destroyed by *Rhizoctonia*.

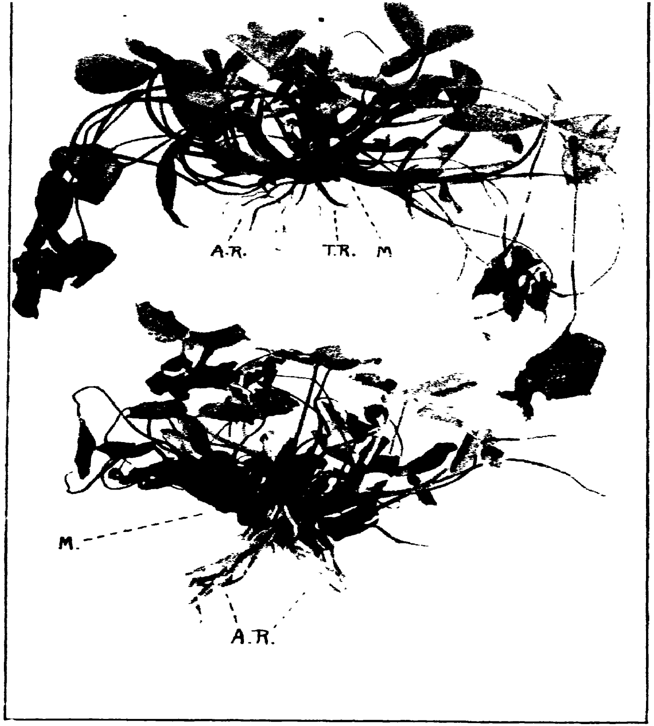

FIG. 5.—Red Clover plants, showing two stages in the replacement of the rotted tap root system

A.R. Adventitious Roots.
T.R. Remains of the central " core " of the Tap Root.
M. Violet, felt-like mycelium on the stipules.

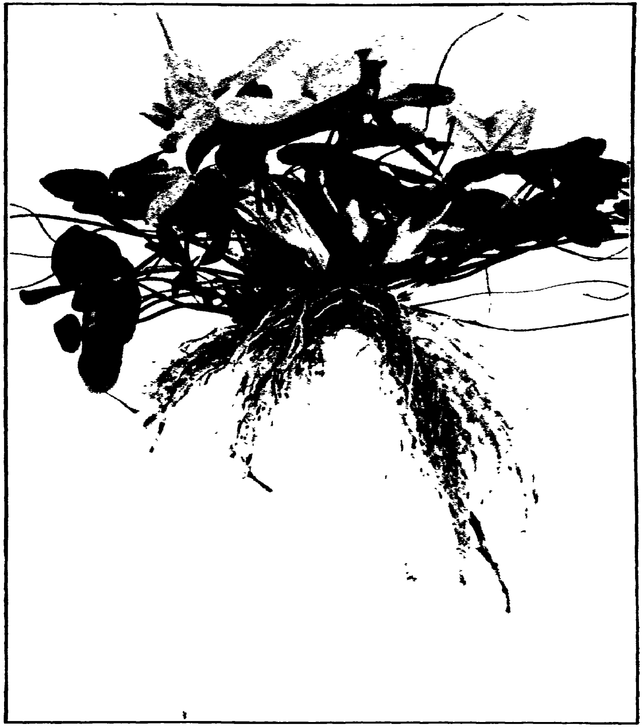

FIG. 6. Red Clover plant having a new adventitious root system, and showing signs of recovery from the disease.

necessarily numerous. The mild, moist weather of this winter although favourable to the fungus, has probably helped the plant during its most critical period: sudden frosts, on the other hand, would probably hinder the recovery of those plants which happened at the time to be practically without roots. The worst effect hitherto noticed, beside the killing of a certain number of plants, is that patches of the clover are retarded, dwarfed, weakened and somewhat thinned.

Amongst the red clover the *Rhizoctonia* was found attacking living plants of Corn Mint (*Mentha arvensis*) a common weed of the district. The upright annual stems had been cut to the same level as the stubble and the violet-brown mycelium enveloped them at ground level, though not lower; some of the lowest lateral shoots were completely encased by the felt-like growth. Small plants of Meadow Grass (*Poa*, spp.) and of Speedwell (*Veronica agrestis*) and a dead plant of Knotgrass (*Polygonum aviculare*) were found thickly coated with the spawn of the fungus, but in none of these cases were sclerotia found.*

The presence of the fungus on both living and inert material indicates that moisture is of considerable importance to enable it to spread; patches of the violet " felt " up to one and a half inches square were frequently found on the smooth surface of flints.

Continuance of the Disease.—The *Rhizoctonia* is able to survive after the decay of the clover roots has taken place. The minute sclerotia are set free in the soil and it is probable that they remain in a dormant condition for some years, many of them starting into active growth each season.† The next serious outbreak will only occur when a crop, suited to the fungus, is again taken on the same field in the ordinary course of the rotation. It is probable also, that since it is capable of attacking weeds, the fungus will exist from season to season on indigenous plants.

Measures of Control.—No experiments in the control of the disease on clover have yet been made. Having regard to the nature of the disease, it is clear that, as in the case of clover sickness, the best preventive measures will be found in giving the affected soil as long a rest from clover as possible. More than eight years' interval between two clover crops is advisable.* In adopting the above measures, it must, however, be borne in mind that this form of Rhizoctonia may live unnoticed upon some other crop, or on weeds, in the meantime.

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* Numerous self-sown oats were germinating at this time amongst the clover, but the only part of these that was seen infested was the husk of the seed oat; neither the shoot nor the seed roots being attacked.

† No spores or fructifications were found by the writer in either the violet or white parts of the mycelium.

Owing to the importance of red clover on the farm, it has been thought advisable to describe this new disease as soon as possible, in order that farmers may become acquainted with the fact of its existence, and to suggest that they would be well advised to obtain expert opinion in cases where clover shows signs of failure.

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REPLENISHING STOCK IN BACK-YARD POULTRY KEEPING.

Lieut.-Colonel F. W. Hardy.

The progressive poultry keeper must always be looking ahead, and preparing for the following winter's egg supply. It must be remembered that the yield of eggs during the autumn and early winter, when prices rule high, comes very largely from the pullets, and these must be hatched, in the case of the lighter breeds, not later than April or early in May, to produce eggs in October and November. The writer is of opinion, after trying several breeds, that for egg-production on the intensive system the light varieties are by far the most profitable. They are so much more active than the heavy breeds, that they do not tend to put on fat in their second year like the latter, and are in consequence well worth keeping through the moult, as they are likely to give a good account of themselves during a second season.

Under such conditions, and making due allowance for possible losses and the weeding out of indifferent layers, one must estimate to replace from rather over one-half to two-thirds of the laying stock each year. There are several ways of doing this, depending much upon circumstances.

1. **When Little Space is available.**—Where the poultry keeper has little or no room available, except for housing his adult birds, or where he is absent all day, and no member of his family is available to look after the chicks, it is much the wiser plan to give up the idea of chicken-rearing altogether, and to buy five months' old pullets at the end of August or early in

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* The previous leguminous crop taken in the field under observation, was white clover and trefoil on one half, and sainfoin on the other, in 1915.

September. They should be purchased from a reliable breeder, *not a dealer*, and should be from stock reared on free range, or nearly so.

Extravagant prices should not be paid, because the birds will not be required for breeding purposes, but neither should the poultry keeper go to the opposite extreme, and expect to get good pullets at the price of second-season hens. Usually, the County Councils have lists of Station Holders from whom reliable stock may be obtained on reasonable terms. In any event orders should be given early in the season, to avoid disappointment.

2. **When Space is not so limited.**—Where space is not so limited, especially if the poultry keeper has a lawn available for the first two months, it is quite feasible to raise chicks successfully, provided the necessary attention can be given to them. On the whole, it is better not to use one's own eggs, and so avoid the necessity of keeping one or more cockerels. Before these are ready for the breeding pen, they have cost a good deal for food, besides being a nuisance to one's neighbours. The resulting progeny, moreover, is not likely to be so vigorous as that from fowls enjoying more freedom, whilst the egg supply from a breeding pen will not be so abundant as where the hens are fed on a more stimulating mash than is advisable for stock-raising purposes. This loss of eating eggs will go far to neutralize the reduced cost of one's own sittings. On every ground, therefore, it is better to purchase eggs for hatching.

The following courses are open: (*a*) Sittings may be bought and hatched under hens, or in an incubator. The writer recommends the former method, as he regards the use of a single small incubator—and the back-yard poultry keeper would hardly require more—as uneconomic. The air temperature in an incubating room should not fall below 50° F. if possible. In the month of March this is only likely to be the case if one selects a warm room in the house, and even then a fire or oil stove may sometimes be needed. Where several machines are in use, the lamps of these are sufficient to render the use of a stove unnecessary. There is, however, another point, often forgotten. If an incubator be used in the house, it is necessary to inform the Insurance Company, who will probably demand an increased premium. If hens are not available, it is often possible to get the eggs hatched for a consideration, the usual charge being 3d. per egg, or in some cases per chick. It is better to do this than to wait for broody hens and lose valuable time. Broodies should be carefully inspected to see that they are free from scaly leg, and as far as possible from lice. They should be well dusted with a good insect powder two or three times during the period of sitting.

(*b*) The alternative to hatching is the purchase of day-old chicks. The success of this method depends on circumstances. Careful packing in suitable boxes is most important. Many chicks die or make a bad start from neglect of these precautions. Where possible it is best to fetch the chicks oneself, and bring them straight home. When this is not practicable, the purchaser should make arrangements to be informed by telegram of the train by which the chicks will travel, and their age in hours. They can then be taken straight from the train and cared for properly. The chicks should not be fed for the first 48 hours after hatching, all they require during that period being warmth, rest, and quiet.

Rearing.—The rearing of chicks on a strictly limited area, requires great attention to detail. Where hens are in use, a two-compartment coop, such as that shown in Fig. 1, is a great advantage; indeed, early in the season or during spells of wet weather, it is almost essential. The right hand compartment contains the hen. She is taken out twice a day to be well fed and watered, also to give her an opportunity of dusting herself. The partition has a sliding door secured by a wedge, so that the chicks can run in and out. Access to both compartments is obtained by hinging the middle third of the roof. The floors are raised 1 in. above the ground level, and are removable; they are covered with fine peat moss or chopped straw. The chicks are always fed in the left hand compartment. The coop illustrated, which is 4 ft. 6 in. long, 2 ft. deep, and 1 ft. 10 in. high, has the sides, back and centre division made out of pieces of asbestos cement sheeting. This material answers very well for the walls, as it does not harbour insects. It is too cold for the roof, which is of wood covered with bituminous felt. Four handles render it very portable, so that it is easily moved to fresh ground. Lastly, there is a wooden framework—not shown in the illustration—of 2 in. by 1 in. battens, measuring 6 ft. by 4 ft. 6 in. by 1 ft. 6 in. and covered with 1 in. mesh wire-netting, which fits in front of the coop, and enables the chicks to run out on the grass, safe from cats or other marauders.

There is nothing so good as a well-mown lawn for rearing purposes. By constantly moving the coop, and brushing over the grass with a besom, the rearing ground can be kept quite sweet, whilst the chicks will benefit greatly from the young grass and clover.

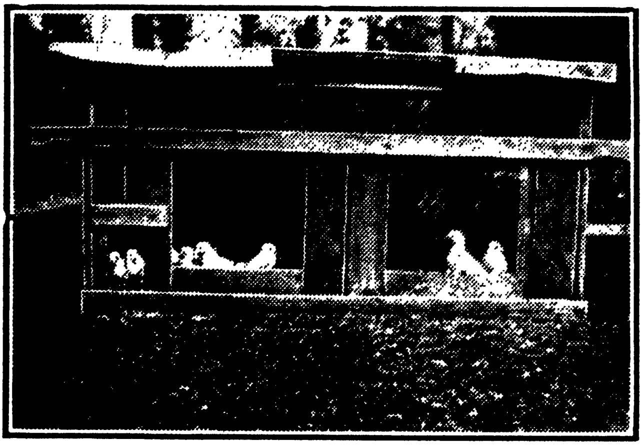


FIG. 1.—Two-compartment Coop for rearing chicks.

Methods of Brooding without Hens.—There are three ways of doing this:—(1) The hover; (2) The fireless brooder; and (3) The lamp brooder.

The Hover.—A good hover makes artificial rearing a very easy matter. There is little danger of overheating, as the chicks are not boxed in, whilst the air is always fresh and no fumes from the lamp should be able to reach them. A hover must, however, be located in a house—a 6 ft. by 4 ft. by 4 ft. type will do quite well. Some chaff litter should be placed on the floor, and where there is any danger from rats adequate protection should be given.

The Fireless Brooder.—It is not everyone who is successful with this method. Something depends on the weather, and a good deal more on the patience and aptitude of the attendant. The writer's one and only experience was in March, 1922. The weather could only be described as vile. Frost nearly every night, cold east winds, and an entire absence of sun, proved a very adverse combination. In spite of every effort, the result was a failure. On the other hand there are many people, chiefly women, who make a great success of it. Rather, however, than court a second disaster, the appliance was quickly converted into a lamp brooder.

The Lamp Brooder (*see Fig.* 2).—This appliance can be easily made by anyone having a fair knowledge of carpentry. The size here described took three dozen chicks comfortably, and cost 25s. all told. The heat was supplied by a hurricane lamp. At the end of five weeks, when the lamp was withdrawn, 38 fine healthy chicks remained. The secret of success with this type of brooder is correct ventilation. There must be a double bottom with a space of one inch between the floors. Air enters this space by a series of small holes bored through one side. A circular hole 7 in. in diameter is made in the centre of the upper floor. A strip of zinc sheeting 3 in. wide and 23 in. long, fits into the well so formed. The ends will overlap one inch, and they need not be soldered. Before inserting this collar, two rows of holes are punched in it, ½ in. and 1¼ in. from the bottom edge. The former admit air to the well, the latter are made to receive a number of nails which fix the collar to the floor. After securing this, any small spaces are filled with putty, as the floor must be quite draught proof. A second collar fitting immediately outside the first and 8 in. deep, is made of perforated zinc. The edges can be secured with thin wire or copper rivets. The object of this is to prevent the chicks getting too close to the lamp. A shallow circular cone made out of sheet iron covers the lamp and takes its support from four screw eyes inserted in the walls. Two and a half inches from the top of the latter are five holes ⅜ in. in diameter in each wall of the brooding chamber. The four corners of this are blocked out by strips of wood 8 in. high placed at an angle of 45°. This is to prevent crowding, with the risk of casualties. A door 5 in. wide and 5 in. high

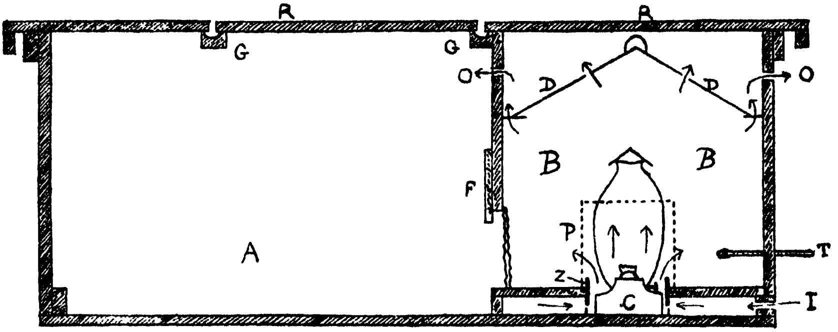


FIG. 2.—Vertical Section of Lamp Brooder. Length 6 ft.; breadth 2 ft. 1⅛ in.: height 1 ft. 11 in. front, 1 ft. 7 in. back. (R) Roof in sections, hinged behind. and covered with bituminous felt. (A) Outer chamber, (B) inner chamber, (C) hurricane lamp, (D) cone of iron sheeting, (I) fresh air inlets, (F) sliding trap door, (G) back to front roof supports with groove to carry off water, (O) foul air outlets, (P) perforated zinc collar, (Z) zinc collar.

leads into the outer (exercising and feeding) chamber and is protected inside by a double felt curtain, slit on the hit and miss principle, while a sliding trapdoor on the outside can be let down at night if the temperature be too low. The roof of each compartment is separately hinged, affording access to the interior and an additional means of ventilation, while a window, preferably double, is let into the lower portion of the front for inspection purposes. If the brooder be on the ground, a small portable looking glass, held at an angle, enables one to see what is going on, but for the first week it is a convenience to place it on trestles. When the heat is just right the chicks are evenly distributed, if too cold they crowd around the lamp, and when too hot they get away from it as far as possible. It is, however, desirable to insert a brooder thermometer through one of the walls, the bulb being about two inches above the floor. Fig. 2 will explain the above description.

The principle of the ventilation of the inner chamber, on which the success of the brooder depends, is as follows: Fresh air enters between the floors and *not* across the backs of the chicks. This air supplies the lamp, which heats the air of the chamber by contact with the glass chimney, by radiation from the flame, and by warming the iron cone, which throws its heat on to the chicks' backs, that part of their body where it is most wanted. The lamp brooder has one advantage over the hover—it can be located in the open.

The outer chamber has an open front, boarded up for 4 in. and covered with 1 in. mesh wire netting. It can be protected in windy weather by a sheet of glass extending to within 3 in. of the top of the wire. Both floors are covered with peat moss or chaff. A small trapdoor, hinged below, gives access for the chicks to the outside.

Feeding.—Correct feeding is of course most important. The following system is in force on one of the best and most successful poultry farms in this country:—

1st 48 hours.—No food.

3rd to 5th day inclusive.—A little pinhead oatmeal fed four times a day. The chicks are still absorbing yolk. Too much food at this period is disastrous.

6th to 14th day.—A good biscuit meal is scalded with boiling water and left to soak for half-an-hour. It is then dried off with Sussex ground oats and fed twice a day. In addition the following dry feed is supplied in the scratching litter:—

15 lb. flaked maize (medium fine).
15 lb. cracked wheat.

15 lb. pinhead oatmeal.
5 lb. cracked hemp seed.
2½ lb. cracked canary seed.

Hemp seed is one of the most valuable food stuffs we have. The protein is of excellent quality, whilst there is a fair amount of oil present, which aids the chick in maintaining its body heat. It also promotes feathering. As, however, the outer covering of hemp and canary seed is hard and impervious, it is *essential* that they be first cracked, otherwise they cause indigestion.

14th day to end of 1st month.—The above dry chick feed is continued and the following dry mash given :—

Middlings 4 parts.
Sussex ground oats 2 parts.
Maize meal 2 parts.
Dried separated milk 1½ } or { fish meal impregnated
Dried yeast ½ } { with cod liver oil.

These last items may be alternated. One part of the above mash should be well mixed with 3 parts of broad bran and placed in hoppers always open.

Cod liver oil is very beneficial to growing stock. An alternative method of feeding it is to rub it up with the bran in the proportion of one teaspoonful of veterinary cod liver oil to each pound of *mash*. When all lumps have been broken down and the oil is evenly distributed, the bran can be mixed with the mash in the amount already noted, and the fish meal may be omitted.

The amount of bran should be reduced to two parts during the second month and one part during the third month.

The above rations are for chicks on free range. When kept intensively a liberal amount of fresh green stuff must be given daily. Finely chopped dandelion and chickweed are two of the best forms of vegetable foods for chicks, and fortunately both are usually plentiful in spring. Fresh lettuce is also excellent, and where watercress can be obtained cheaply, there is nothing better.

It should go without saying that an abundance of fresh clean water should always be before the chicks, in vessels that are not easily polluted. It is of equal importance that from the first, a little coarse sand should be always before the chicks. This is much to be preferred to the fine sharp flint grit usually recommended.

Fig. 1 appeared in "*Eggs*," on 7th June, 1922, and the writer's thanks are due to the Editor of that publication for the loan of the block.

* * * * * *

THE COLORADO BEETLE.

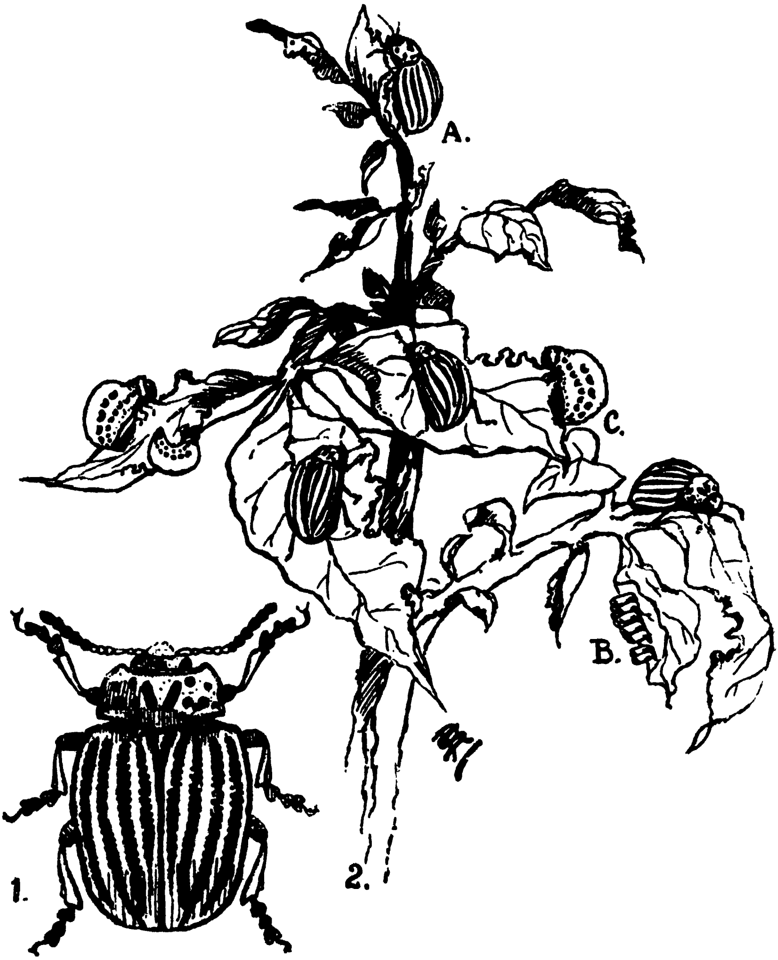
THIS beetle (*Leptinotarsa decemlineata*, Say.)—notorious as a potato pest—was first discovered in the west of the United States where it was living upon a wild plant related to the potato. About the year 1850 it was first noted on potatoes and by 1874 it had spread eastwards across the continent of America to the Atlantic and also northward into Canada. On several occasions it has been carried by shipping to Europe and has even established small colonies which up to the present have been stamped out by the use of drastic measures—as, for instance, at Tilbury in 1901-1902. In 1922 the beetle was discovered in France in the neighbourhood of Bordeaux, about 100 square miles being infested. This is the most serious outbreak which has yet occurred in Europe and it renders great vigilance advisable on the part of potato growers in order to prevent a similar occurrence in Britain.

Description and Life-History.—The adult beetles (Fig. 1) are about half-an-inch in length, yellow in colour with five longitudinal black lines on each wing-case—ten lines in all. The winter is spent under the soil, usually about ten inches below the surface, but less frequently the beetles winter among rubbish. When the weather becomes warm in spring or early summer they come out, pair, and the females fly in search of potato plants, tomatoes or such related weeds as deadly nightshade, upon which to feed and lay their eggs. As the beetles may become active before the majority of the potato crops are above ground, the insects may be forced to fly considerable distances to find their food. On reaching potato plants they feed on the foliage (Fig. 2. A.) and also lay eggs—yellow and oval in shape—on the undersides of the leaves (Fig. 2. B.). The eggs are laid in clusters of from ten to forty and in a week or longer, according to the weather, hatch into red-brown larvæ or grubs (with six legs but no wings) which eat the potato leaves and grow rapidly, becoming paler in colour, varying from orange to brick-red, and noticeably spotted with black (Fig. 2. C.) The grubs feed for three weeks, probably longer if the weather is cold, and, if numerous, strip the plants of their foliage and even eat the haulm to the ground; they then bury themselves in the soil, where they change to pupæ and subsequently to adult beetles. In accordance with the climate there may be one, two or even three generations in the summer. On the approach of cold weather in the autumn the beetles bury themselves in the soil to await the following spring.

The Risk to Britain.—Taking into account the records of the behaviour of the Colorado Beetle in the outbreaks which have already occurred in Europe, it seems only too likely that the insect would find the climate of England congenial and that it would in consequence cause great loss, the nature of which is evident, since a potato plant devoid of foliage or eaten to the ground cannot produce a crop.

As regards the means by which the insects may be expected to reach our shores, it is fairly certain that they cannot fly from Bordeaux, still less from America, and they must therefore come on board ship. In this connection it is obviously the adult beetles which are to be feared, since they can fly on to vessels or crawl into packages awaiting shipment, and on arrival at an English port they can again fly, if necessary for several miles, until they meet with food. Spring or early summer is the most dangerous period, for the beetle is then most likely to wander and a single female will be sufficient to start an outbreak. On the other hand, beetles arriving in England in autumn are infertile, must wait until the spring, and then the two sexes must meet before breeding can take place, a coincidence which is evidently unlikely to occur. Still more remote are risks from the introduction of larvæ, since for all practical purposes they may be regarded as incapable of travelling for more than a few yards and must therefore be actually placed among growing potato crops if they are to live. The same applies with equal force to eggs. The practical application of this is that no matter what regulations are made to guard against the importation of the Colorado Beetle, some risk must still remain, since no precautions can prevent a beetle from flying on to a ship in America or France and flying off again when the vessel reaches an English port. With the establishment of a colony of the pest so near as Bordeaux this risk is very definite and, unless the French are successful in their attempts at eradication, it is by no means unlikely that England will have to deal with an outbreak before many years are past.

Prevention and Control.—Such legislative measures as are possible have been, and will be taken to reduce the chances of the importation of Colorado Beetles and, as these measures must vary from time to time, the Ministry will issue special notifications. If an outbreak is discovered drastic measures will again be necessary in attempting to extirpate the pest and will probably be successful provided they are taken in time. It will, however, be exceedingly difficult to stamp out a colony after it has been present for a year or more and, if this should occur, the insect will probably have to be numbered among our regular potato pests. Growers will then find that they can only obtain a crop if they spray it twice during the summer with lead arsenate or other poisonous wash, and they can in consequence estimate the loss annually as the cost of two spray applications—a severe addition to the expenses of a crop in any case costly to grow.



The Colorado Beetle.
FIG. 1.—Beetle. FIG. 2.—Damaged potato foliage, showing :—
(*a*) beetle, (*b*) eggs, (*c*) larva.

It cannot therefore be urged too strongly that growers, in their own interest as well as in that of the country, should keep a careful watch for any suspicious pests on their potato crops, and notably for yellow and black insects feeding upon the foliage. By notifying the Ministry at once they may be the means of preventing the establishment in England of perhaps the most serious insect enemy of the potato known up to the present.

Legislation.—The Colorado Beetle was made the subject of legislation in 1877 by the Destructive Insects Act, and it is included among the insects scheduled under the Destructive Insects and Pests Order of 1922. This Order renders it illegal to land, sell or offer for sale in England and Wales any living specimen of the beetle, without the written permission of the Ministry. Owing to the appearance of the pest in 1922, in the neighbourhood of Bordeaux, the importation of living plants or vegetables into this country from a certain area in southern France is prohibited by the Colorado Beetle Order of 1922. Copies of the above mentioned Orders may be obtained on application to the Ministry.

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BLACK CURRANT GROWING IN NORFOLK.

H. GOUDE, N.D.H.,
Horticultural Superintendent for Norfolk.

EAST NORFOLK has become the most important centre for Black Currant production in England. The reason for this development is due to exceptional local conditions favouring the growth of the crop, and the skilful use of these facilities by the cultivators. These men were the first to recognise " reversion " as a serious trouble, but called it " nettle-leaf "—a most appropriate definition of this condition. Here we have large areas of light loam soils of great depth and good natural drainage, but still moisture holding. The favoured spots come under the influence of the sea and broads, and even in sultry weather the air in this neighbourhood has a freshness in it that is well known and appreciated by the numerous visitors who come to the district each season.

Varieties and Strains.—The choice of varieties is an important item, but the actual strain of the particular variety is of greater consequence. We find, for example, that the cropping power of individual bushes of any sort is greater than that of their neighbours. It is now customary to build up stocks from these selected specimens, and many of our cultivators have built up particularly good strains of all the profitable varieties. French Black, Boskoops and Victoria are most widely grown, with Baldwin and Black Naples to a less extent. The new varieties raised at Westwick by Mr. G. Davison, Col. Petre's Fruit Farms' Manager, will give a further impetus to currant culture, and Daniel's September Black will extend the season. Seabrook's strain of French Black is very popular owing to its resistance to "mite" infection. At present the French Black strain holds the field for popularity, and with good cultivation has produced the heaviest crops and as large a berry as any variety.

In beginning a plantation a clean stock is essential to success. Black currant production is a costly business, and if the expenditure is being made on an inferior strain the results will be only moderately good or possibly show a loss. The scientific opinion on "reversion" leads one to infer that it is a virus disease and probably carried by gall-mites. We have proved that reversion developes with gall-mite infection and is sometimes present in the offspring of the infected bush without the presence of gall-mites. The writer believes that "reversion" is directly due to the toxic influence of the mites, and careful demonstrations have entirely upheld this theory. Plants are raised from cuttings taken at the end of May and propagated in frames. Any external mites carried by these cuttings are killed by dipping and the resulting plants are free from mites. From previous experience we can say that no "reversion" will appear in these plants until they show big buds caused by mite infection. It is the realisation of this factor at the beginning that makes success possible.

Soil Preparation.—Sub-soiling is essential for long life in the plantation. The anchor roots of the bushes need a free range, and the fine fibrous feeding surface roots should not be unduly disturbed when once established. In one year from planting these surface roots permeate the whole top soil in the plantation. In sub-soiling the top soil is turned and a plough with only the share on breaks the bottom of the furrow. A soil that "pans" easily is not good for this crop. Rotted yard manure up to thirty loads per acre is ploughed in the surface furrow. Providing the land was clean before this preparation it is now ready for planting. One would expect that planting after a root crop would give the best plants, but a stubble is preferable as the land can be cleaned after harvest and got ready for early November planting. A root crop is on the land in November and often carted off in wet weather, consequently the soil is lumpy and cannot be made so friable as the stubble land.

Planting and Pruning.—Where the cultivation is carried out by hand labour, 6 ft. by 6 ft. is the usual distance from bush to bush. On large areas where horse labour is to be used 7 ft. by 7 ft., and for the strongest growers 8 ft. by 8 ft. is more satisfactory. After repeated trials one-year-old bushes are found to give the highest satisfaction. These are planted at the stated distances and cut down. One or two cuttings from the tops are inserted between the bushes in the rows. One cutting back will usually secure sufficient breaks from the base. The next season the plants from the cuttings would be cut back, and the only pruning necessary afterwards is to cut out the old branches that do not produce vigorous shoots, *and branches too near the ground.* A rather dense bush tends to greater fruit production, and the weight of fruit opens out the thickest bushes.

The advantage of the closer spacing in the rows is that the earlier pickings yield double the crop and the plantation is easier to keep clean.

Cultivation and Manuring.—After planting the land is got into a good tilth as early as possible the following spring, and this condition is maintained as far as possible during the growing season. This is accomplished by horse-hoeing, and hand-hoeing round the bushes in the rows. Care is taken not to pull the soil away from the plants. If weed growth becomes dense, the bushes are seriously checked in development and many plantations are ruined in this way. Intercrops are grown for two or three years; peas, early potatoes, onions or mangolds are most suitable, but these crops must not be allowed to compete with the bushes. Cultivation is for the purpose of maintaining a tilth in the early years and for keeping the plantation free from weeds in after years. In many of the old plantations near the broads the land is top-dressed with reeds annually. This covering prevents weed growth and the surface soil is kept open.

In the older plantations winter soil work by hand labour is required as the bushes cover the land. In young plantations three or four furrows are ploughed next to the rows of bushes leaving the centre open for drainage. Both digging and ploughing near the bushes should be very shallow in order that the important surface roots do not get disturbed, and care should be taken not to knock the bushes about with the plough or cart. The winter soil working gives sufficient loose soil for summer tillage. From five to ten loads of farmyard manure per acre should be used each year. After the first season's growth, a fork-full is given to each bush as a top-dressing, and repeated in larger doses after fruiting each season. Bone meal is useful as an alternating food and gives texture and weight to the crop. Soot and occasionally lime and soot are applied as a spring dressing. Fish meal has several supporters. Generally speaking, our best cultivators depend chiefly on pig manure and bone meal.

Cost and Production.—The cost of establishing and cultivating an acre of black currants works out as follows:—

Establishing Cost.

	£	s.	d.
Bushes	£8	0	0
Manure (30 loads)	15	0	0
Soil-working, cleaning and sub-soiling ...	2	10	0
Planting and cutting	2	0	0
	£27	10	0

Annual Cost.

	£	s.	d.
Labour and horse cultivation	£18	0	0
Manure (10 loads)	5	0	0
Rent, rates and taxes	5	0	0
Chips, etc.	13	0	0
Picking	20	0	0
Carriage on Fruit	13	0	0
	£74	0	0

The cost of chip baskets, picking, and carriage, is expected to fall, but the annual cost is not likely to be less than £50 per acre. The above costs are actual figures from a dependable and successful cultivator. Two tons per acre is a good average yield for a black currant crop. A few growers have more than doubled this weight. With the price of black currants at present rates, the business is worth the risks, but with any big drop in the price, the cultivation of this crop will be unprofitable for a large proportion of cultivators. In view of the weight of jam made per ton of fruit, the cost of black currants to the jam makers has not been so high proportionally as other fruits. The development of this industry has had a beneficial effect on the districts it covers, as the money paid for picking goes into the poorest homes.

Insect and Fungoid Pests.—The most serious trouble still is the gall-mite. It is kept within bounds in many large plantations and "big buds" are difficult to find. This is only possible by ceaseless vigilance—with any neglect or mismanagement the pest shows up in force again. Aphids are not so troublesome as they were. A few years back they seriously damaged crop prospects, but for the past five years the attack from this quarter has been slight. Various caterpillars have given attention to the bushes lately—tortrix, winter, and March moth larvæ have been identified—and a spraying with arsenate of lead has been necessary to check them. The currant root aphid, which is covered by a woolly material like that of the woolly aphid of the apple, infests the root system in many plantations, but no deleterious effects have been observed from this source so far. Among fungi *Cronartium ribicola* is the most serious. and will sometimes appear in July and defoliate the bushes in August. When this happens the next season's crop has always been light. When it begins to show late in September no harmful results are noticeable. The gall-mite is, however, the only serious enemy of the black currant.

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THE RURAL SECONDARY SCHOOL AS A FACTOR IN AGRICULTURAL EDUCATION.

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Samuel King's School, Alston.

As a firm believer in the usefulness of the rural secondary school in a complete system of agricultural education, the writer, some years ago, began to extend the scope of the educational activities of his school to include the provision of lectures to the farming community.

The school is situated in a remote and isolated area of the Pennines. The surrounding country is chiefly permanent grass pasture largely farmed by small farmers, who rear cattle and sheep. Practically no arable land exists in the district.

The improvement of grass land, the rearing and feeding of stock, the diseases to which stock are subject, are all problems of first-class importance to the district; and it was obvious to the writer that the farming community not only needed the results of modern scientific research but were eager to acquaint themselves with modern ideas and apply them to the solution of their problems. Contrary to the general view, he has found the farmer willing and eager to learn.

In 1913 a modest scheme of local lectures on farming subjects was prepared and sanctioned by the Governing body of the school. The intervention of the War created difficulties, but enough experience had been gained to show that a very good field of educational work was open.

In 1919 the scheme was extended and lectures were organised during the winter sessions These have proved popular and beneficial. The attendance is good, many farmers coming long distances in severe weather over mountainous and desolate roads.

The lectures, which usually last about an hour, are followed by questions and interchange of opinions. This is a valuable feature and not only the audience but lecturers have gained first-hand information of a practical and important nature. Facilities are given to farmers to consult the lecturer on problems which have arisen, and it is becoming quite a common feature for lecturers to visit farms in the neighbourhood and study the problem on the spot. During the summer, excursions are organised to places of interest to the farmers.

In this way it has been possible to bring to many farmers the advisory help of the central agricultural college for the area (Armstrong College, Newcastle-on-Tyne), and of the Newton Rigg Farm School.

In framing a scheme of lectures it is important that the subjects should have a direct bearing on the type of farming of the area, that the lecturers should be men of tact and good practical knowledge, and that they should avoid scientific jargon. Men of outstanding authority in a particular subject are much appreciated, and where possible we have endeavoured to obtain their services.

The cost of the scheme has been met in the following way. The County Education Authority of Cumberland allocates a yearly grant to the Agricultural Department of Armstrong College, Newcastle-on-Tyne. On account of this grant the county receives many privileges from the College, and as the result we have been able to secure the valuable services of Professor D. Gilchrist and his staff. Secondly, the Newton Rigg Farm School is jointly financed by Cumberland and Westmorland, and we have been greatly indebted to Mr. Lindsay Robb, the principal, for lectures, advice and lecturers.

On the whole, the scheme has cost the school little, while the educational return has been great. Incidentally the younger generation receives more encouragement to attend farm schools, and the farmer has seen that money spent on secondary education in this area is not a vain thing.

The following examples of lectures already given may be of interest:—

Grassland and its Improvement.
Breeding of Sheep, especially in relation to the Improvement of Wool.
Sheep Scab and Sheep Dipping.
Contagious Abortion.
Economical Calf-rearing.
The Production of Grade A Milk.
Foodstuffs and their Value.
Recent Progress in Veterinary Research.
English Wool and its Improvement.
The Present Supplies of Concentrated Manures.
Manures, their Use and Abuse.

As lecturers we have had Professor Gilchrist, M.Sc., Sir Daniel Hall, K.C.B., F.R.S., Professor A. F. Barker, M.Sc., W. Jackson Young, Esq., F.R.C.V.S., Profesor Cosser Ewart and many others.

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BREEDING ANGORA RABBITS FOR WOOL.

IN the issue of this *Journal* for October, 1916, an article appeared on "The Rearing of Angora Rabbits for their Wool," giving a comprehensive account of the methods and conditions necessary for successful wool production as obtaining in France, where it forms a profitable small industry. In view of the increasing interest which is being taken in this subject the Ministry has caused inquiries to be made with regard to the breeding of Angora Rabbits for wool in this country, and the following additional information has been obtained by one of the Ministry's Inspectors.

Clipping.—The usual method of securing the wool crop is said to be by clipping with an ordinary pair of scissors, carefully done so as to secure the fullest possible length of the staple. Plucking, it is stated, is only satisfactory when the rabbit is fully in moult, and it is not easy to gauge when this condition exists. The method of test is to pull out about a dozen strands together. If the animal is ripe for plucking these should come out easily and without leaving any sore appearance on the skin. The times of moulting vary greatly and depend, it is thought, much on the condition of the parents when mating takes place. With parents " tight " in coat it is believed that the progeny will moult less frequently and the wool will, therefore, be longer and of greater value.

Crops.—It is desirable to aim at about three crops of wool a year from each rabbit—that is to say, a young rabbit born in the autumn would be clipped at about 4 months old and may be expected to give two more crops within the 12 months.

Housing.—If kept in any numbers, the does can be put together when clipped, unless they fight, but when in coat each rabbit must be kept in a separate hutch, which should not measure less than 2 ft. 6 in. by 2 ft. by 1 ft. 6 in. high. Angora rabbits are said to be hardy and prolific if kept free from damp or draught. For bedding, wheat straw cut into 9 in. lengths is suitable. Sawdust (unless covered with wheat straw), oat straw and barley straw are unsuitable as they get entangled in the wool.

Grooming.—The rabbits need brushing once daily to keep the coat from matting, and a brush with short stiff bristles fixed in a pneumatic base is recommended. The wool which comes away on the brush is saved.

Feeding.—Mashes and meal are unnecessary, green food, clover hay and good whole oats meeting all requirements.

Marketing of Wool.—With regard to results, the average Angora rabbit produces 12 oz. of wool per annum, and it is reckoned that at present prices an average net profit of 20s. per annum is realised. It is not known that there are any persons in this country breeding Angoras as a whole-time business, or on a large scale, but it is said that there is no difficulty whatever in disposing of wool. The Ministry has been informed that Mr. J. Holmes, Hon. Secretary, Universal Angora Rabbit Society, of 44, Old Birch, Darwen, is willing to accept consignments of wool, in parcels of not less than ½ lb., provided it is clean and to some extent graded, but only white wool is wanted at present. Mr. Holmes has been appointed by the Society to dispose of wool on behalf of members and others, and the wool is consigned to a spinner who is stated to have agreed to take all he can get up to a quantity representing the wool from 10,000 rabbits. The price for the best wool from white Angora rabbits has increased lately, and is stated to have been as much as 40s. per lb. in January last.

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GOOSE-KEEPING FOR FEATHERS AND SKINS.

THE rearing of geese for the production of feathers, down, and dressed skins, has been practised in Poitiers for several centuries and has led to the breeding of a goose especially adapted for the purpose. The feathers and down are plucked from the goose at different stages during its growth, and are sold for millinery and bedding purposes. The dressed skins are used in the manufacture of so-called " furs " and of delicate powder puffs, some of the best skins fetching as much as 20 francs each, and the carcasses are sold for the table.

The total output of skins from the district is estimated at 12,000 dozen per annum at a value of two million francs. The estimated value of the feathers is put at another two million francs, and the flesh at eight million francs.

Characteristics of the Poitou Goose.—The Poitou Goose is reputed to be superior for the purpose to any other of the white breeds in Europe, in having snow white plumage without any trace of black or grey. An abundance of long, white, fine down is carried upon the breast.

The bird is compact, rather short, broad and deep in body, short on the leg, with a relatively long neck. The head is rather round and short, with an elongated beak of a reddish colour in the adult. The young ganders average 14 lb. and geese 12 lb. in weight, whilst the adults are perhaps 2 lb. heavier. The goose at maturity will produce 20-50 eggs a year. Although not a prolific layer the breed possesses all the characteristics for economical production of skins and flesh, and is an active and good forager.

Breeding.—Young geese are bred and reared by farmers, who raise flocks of from 50 to 100 young birds annually. The general practice is to retain only four geese, the requisite number for mating with a gander, although in some cases five can be mated. The breeding flocks are thus limited, owing to the fact that the bellicose nature of the ganders interferes with fecundity if more than one is kept.

For breeding, the birds should be over two years of age, and it is well to replace them at seven or eight years. The heaviest birds are seldom selected for reproduction, a gander of about 15½ lb. weight being mated to geese weighing 13 lb. The matings are made from 6 to 8 weeks before the first eggs are

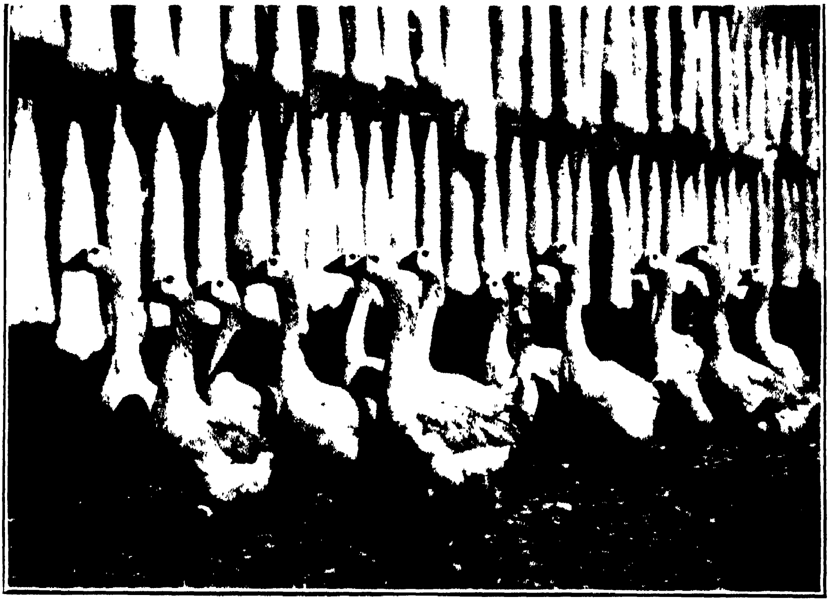

FIG. 1. —A group of White Geese of Poitou, showing also the tanned skins.

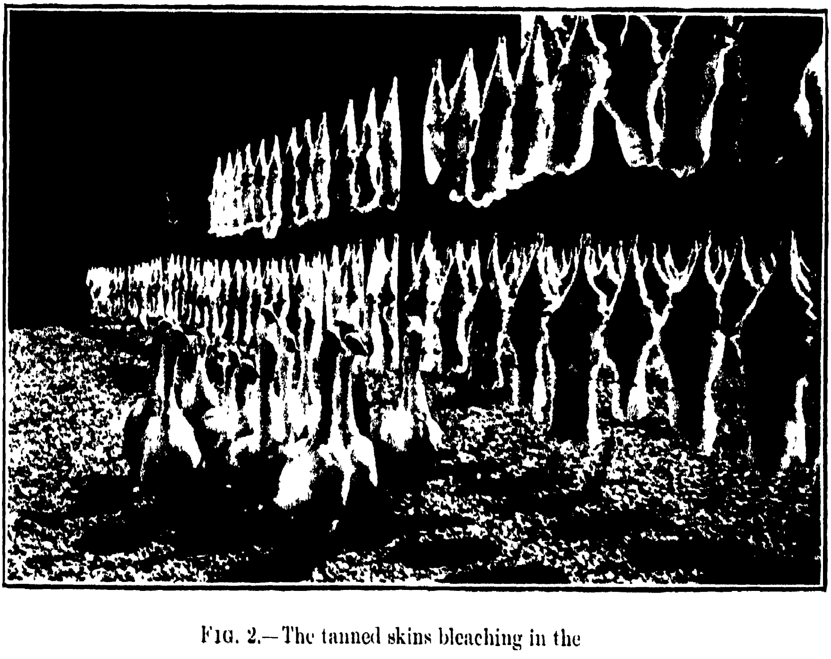

FIG. 2.—The tanned skins bleaching in the

expected. Grass and cabbage constitute the daily diet of the adult stock, supplemented with a small ration of oats during the breeding season to induce egg production.

Hatching and Rearing.—Artificial hatching is not practised. The first laying of the goose is from 12-15 eggs, and since the second batch of 6-8 eggs is late, it is generally found better to allow the goose to sit upon her own eggs. The first batch of 10-12 eggs is, however, sometimes entrusted to a turkey or to hens, if there is a prospect of the goose continuing to lay.

The main hatches are out by the end of March, at which period each breeder has from 35-50 goslings. It is interesting to note, as an instance of the practical nature of the people engaged in this industry, that the food resources of the holding are reckoned up at this time, and the flock reduced by the sale of a portion of the goslings at 15 days old, if it is found that the natural resources of the holding are insufficient for the flock hatched.

The goslings require little attention. Shelter from sun and rain is important as the young birds are subject to sunstroke and susceptible to dampness. The goslings are not allowed to enter water before they are 15 days old.

Feeding is simple and economical and the result of long experience. The food given after 36 hours consists of bran and nettles finely chopped and moistened with water. Cabbage leaves are also used, and at four to five weeks old a small quantity of oats are added. This assists the growth of the wing feathers, and at eight weeks, when the wings cross, this addition of oats to the diet is very necessary. With the foraging in meadows and this simple feeding the goslings reach a weight of 6-7 lb. at eight weeks old. The birds are seldom fattened, as fattening detracts from the value of the skin. Carrots are, however, sometimes given with the object of fattening.

After reaching 15 days old the goslings are allowed on to water and the whiteness of the feathers is attributed to frequent bathing in the waters of this region—waters which contain traces of salts of lithia.

Plucking.—The young birds are usually plucked three times, and produce about ¼ lb. of bedding feathers, in addition to down, at each plucking.

Marketing.—After setting aside geese required for future breeding. the young geese are taken to special markets for sale alive. It is most necessary to choose the time for marketing exactly eight weeks after the previous plucking in order to effect the marketing of the skin in fit condition.

Skins.—The killing and skinning of the goose is carried out by collectors or poulterers. The latter is done while the carcass is still warm, the feathers being plucked from the skin and the down left on. The skins are dried for 10-15 days, after which they are packed and sold in dozens, following which they are specially cured and prepared, to produce the white and fluffy appearance which is their chief value.

Feathers.—The large feathers of the wings and tail are used for the manufacture of artificial wings, or the tail feathers are split for use in feather boas. The ends of the quills are made into toothpicks. The crop feathers are used in making artificial birds or for ornaments, and finally the remains of the wings are formed into household dusters.

In such a specialised industry developed over a long period, as is often the case, the methods employed are practical and economical, and appear simple when related. It is, nevertheless, obvious that the skill and knowledge acquired by long practice are an essential part of the industry, and even the special goose, in unskilled hands, would not yield the same desirable results. It may also well be that the local conditions have some special bearing upon successful production, and the reputation which the breeders of Poitiers have won is not easily to be imitated.

Geese are, however, the most simple of all poultry stock to manage, as pasture land supplies almost all their food, and they are especially adaptable to the small farmer, since very little capital or labour is required.

The information in this account has been obtained from an article by M. Legendre in the *Revue de Zootechnie* for 15th November, 1922, and an article by M. Charon in the *Journal d'Agriculture Pratique*, 1st July, 1922. The illustrations are reproduced from the latter article by kind permission of the editor.

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OFFICIAL SEED TESTING, 1921-22.

THE Annual Report of the Official Seed Testing Station will be published by the National Institute of Agricultural Botany in the "Technical Record" for 1922, which will shortly be available. The following notes summarise the results during the season ending 31st July, 1922.

The number of samples received for testing was 25,822, an increase of over 2,000 on any previous season's total. In March, 5,185 samples were submitted. The number of farmers using the Station was 35 per cent. higher than in the season of 1920-21. There was a large increase in the number of samples of cereal and red clover seeds received, but a decrease in samples of vegetable seeds; other kinds showed little change

As might have been expected after the dry summer of 1921, home-saved seed was of better quality than usual. The main points of interest are set out below:—

Cereals.—The germination of wheat and barley was well above the average, and that of oats and rye about equal to the average of previous years. Only 2½ per cent. of the wheat samples showed germination below 90 per cent. There was a very large increase in the number of samples of wheat affected by bunt or showing traces of ear-cockles, but there was much less ergot in rye.

Roots and Vegetables.—The germination was on the whole slightly above the average, but parsnip, carrot and onion samples were of relatively poor growth. Mangold and beet were of high quality.

Clovers.—English red clover showed an average germination of 83.6 per cent. as against an average for the past four years of 76.3 per cent. Its purity showed improvement also, this being most marked in the case of injurious weed seed content. Whereas in the two previous seasons 8.1 and 7.4 per cent. of samples of English red contained 1 per cent. or over of injurious weed seeds, the figure for 1921-22 was below 1 per cent. English white clover showed a similar but less marked improvement. Sainfoin was of better quality than in any of the four previous seasons. Czecho-Slovak clovers, which were of low purity in the two previous seasons, showed considerable improvement in this respect.

The dodder content of all clovers was slightly above that of the previous season—this was probably due to the fact that the climatic conditions for ripening the seed were more favourable than usual.

Grasses.—It is rather difficult to draw any close comparison between the purity and germination figures for the past season and those for previous seasons, since there has been a radical change in the manner of testing. Now that the Continental method is being used lower purity figures and higher germination figures result. Making allowance for this, however, it seems most probable that ryegrasses were scarcely up to the usual standard, that Timothy and meadow fescue were of average quality, and that cocksfoot and dogstail were about the average. It might perhaps be noted that the new crop ryegrasses were of excellent quality, though short in quantity, but the average was lowered by the large amount of old seed on the market.

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MONTHLY NOTES ON FEEDING STUFFS:

FEEDING FOR BACON PRODUCTION.

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IN the March issue of the *Journal*, it was pointed out that poor quality bacon results from the use of unsuitable mixtures of feeding stuffs, particularly towards the end of the fattening period. It is, however, possible to produce the wrong type of carcass from a pig, which, from the breeding standpoint, has all the points necessary for the formation of ideal bacon, even though suitable feeding stuffs are used. The ideal side, from the bacon curer's standpoint, is one weighing 50-60 lb. when finished, with good ham, thick streaking and good loin, the middle weighing a few pounds more than the ends. Above all, the proportion of lean to fat must be high, and the back fat should never be more than 1½ in. in thickness. A bacon pig of the right type, and weighing 200 lb. live weight, should kill out at 160 lb. dressed weight at about 5-6 months old. Whether the pig kills out at the right proportion of lean to fat depends largely upon the judgment of the feeder in maintaining the right proportion between the albuminoids and non-albuminoids throughout the growing and fattening period. In fattening the pig, the pig feeder is dealing with an animal in an actively growing state, and it is therefore necessary to provide adequately for the growth of the animal as well as for fattening. This is a very important point, and an error in feeding during the early stages of fattening is not easily put right later. If pigs receive insufficient protein (albuminoids) during the early stages they will kill out unduly fat at 200 lb. live weight. In the early stages of the pig's life, the nutritive ratio of the ration should be as narrow as 1 : 3 or 4, widening out in the latter stage of

DESCRIPTION.	Price per Qr.		Price per			Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.								
	s.	lb.	s.	£	s.	£	s.	£	s.		s.	d.
Wheat, British - -	41/6	504	9/3	9	5	0	18	8	7	71·6	2/4	1·25
Barley, British Feeding	27/0	400	7/7	7	12	0	14	6	18	71	1/11	1·03
,, Danubian ,,	29/6	—	8/3	8	5	0	14	7	11	71	2/2	1·16
,, Persian ,,	26/9	—	7/6	7	10	0	14	6	16	71	1/11	1·03
Oats, English White -	30/–	336	10/–	10	0	0	16	9	4	59·5	3/1	1·65
,, ,, Black & Grey	27/0	—	9/0	9	0	0	16	8	4	59·5	2/9	1·47
,, Scotch White -	36/–	—	12/–	12	0	0	16	11	4	59·5	3/9	2·01
,, Canadian No. 2 Western	30/0	320	10/6	10	10	0	16	9	14	59·5	3 3	1·74
,, ,, No. 3 ,,	28/3	—	9/11	9	18	0	16	9	2	59·5	3/1	1·65
,, ,, Feed -	27/6	—	9/7	9	12	0	16	8	16	59·5	2/11	1·56
,, American - -	25/3	—	8/10	8	17	0	16	8	1	59·5	2/8	1·43
,, Argentine - -	25/0	—	8/9	8	15	0	16	7	19	59·5	2/8	1·43
Maize, Argentine - -	38/6	480	9/0	9	0	0	15	8	5	81	2/–	1·07
,, American - -	37/6	—	8/9	8	15	0	15	8	0	81	2/–	1·07
Beans, English Winter -	46/–	532	9/8	9	13	1	18	7	15	67	2/4	1·25
,, Rangoon - -	—	—	8/9	8	15	1	18	6	17	67	2/1	1·12
Peas, English, Dun -	56/–	504	12/5	12	8	1	13	10	15	69	3/1	1·65
Rye, Home-grown -	36/–	—	8/–	8	0	0	18	7	2	71·6	2/–	1·07
Millers' offals—												
Bran, British - -	—	—	—	7	2	1	11	5	11	45	2/6	1·34
,, Broad - -	—	—	—	8	5	1	11	6	14	45	3/–	1·61
Fine middlings (Imported) - -	—	—	—	9	0	1	6	7	14	72	2/2	1·16
Coarse middlings (British) - -	—	—	—	7	2	1	6	5	16	64	1/10	0·98
Pollards (Imported)	—	—	—	6	12	1	11	5	1	60	1/8	0·89
Barley Meal - - -	—	—	—	10	0	0	14	9	6	71	2/7	1·38
Maize ,, - - -	—	—	—	10	5	0	15	9	10	81	2/4	1·25
,, Germ Meal - -	—	—	—	9	5	1	2	8	3	85·3	1/11	1·03
,, Gluten-feed -	—	—	—	9	5	1	12	7	13	75·6	2/–	1·07
Locust Bean Meal -	—	—	—	8	7	0	11	7	16	71·4	2/2	1·16
Bean Meal - - -	—	—	—	12	0	1	18	10	2	67	3/–	1·61
Fish ,, - - -	—	—	—	16	10	5	0	11	10	53	4/4	2·32
Linseed - - -	—	—	—	20	15	1	16	18	19	119	3/2	1·70
,, Cake, English (9°/₀ oil)	—	—	—	12	17	2	5	10	12	74	2/10	1·52
Cottonseed Cake, English (Egyptian Seed) (5½°/₀ oil)	—	—	—	7	11	2	0	5	11	42	2/8	1·43
,, ,, Egyptian (5½°/₀ oil)	—	—	—	7	10	2	0	5	10	42	2/7	1·38
Coconut Cake (6°/₀ oil)	—	—	—	8	15	1	15	7	0	73	1/11	1·03
Palm Kernel Cake (6 °/₀ oil)	—	—	—	7	0*	1	7	5	13	75	1/6	0·80
,, ,, Meal (2°/₀ ,,)	—	—	—	5	15	1	8	4	7	71·3	1/3	0·67
Feeding Treacle - -	—	—	—	4	5	0	9	3	16	51	1/6	0·80
Brewers' grains, dried, ale	—	—	—	7	17	1	8	6	9	49	2/8	1·43
,, ,, ,, porter	—	—	—	7	10	1	8	6	2	49	2/6	1·34
,, ,, wet, ale	—	—	—	1	12	0	11	1	1	15	1/5	0·76
,, ,, wet, porter	—	—	—	1	8	0	11	0	17	15	1/2	0·62

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of January and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 2d.; P_2O_5, 4s. 7d.; K_2O, 2s. 10d fattening to 1 : 5 or 6. Adherence to these ratios will produce the right type of carcass, provided, of course, that a good type of bacon pig is being used. From a practical standpoint, the pig feeder will need to take care that sufficient food rich in proteins is included in the mixtures fed. The home-grown feeding stuffs, wheat, oats, barley and rye, all have too wide a nutritive ratio and need to be used in conjunction with a feeding stuff rich in protein, such as peas, whey, meat meal, dried blood, etc. The proportions in which these several feeding stuffs require mixing to obtain the best results can be worked out from the tables given in Miscellaneous Publication No. 32, Rations for Live Stock.

FARM VALUES.

CROPS.	Value per Ton on Farm.		Manurial Value per Ton.		Food Value per Ton.		Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£	s.	£	s.	£	s.		s. d.	d.
Wheat - - - - -	8	1	0	18	7	3	71·6	2/0	1·07
Oats - - - - -	6	15	0	16	5	19	59·5	2/0	1·07
Barley - - - - -	7	16	0	14	7	2	71·0	2/0	1·07
Potatoes - - - -	2	0	0	4	1	16	18·0	2/0	1·07
Swedes - - - -	0	17	0	3	0	14	7·0	2/0	1·07
Mangolds - - - -	0	15	0	3	0	12	6·0	2/0	1·07
Good Meadow Hay - -	4	19	0	16	4	3	31·0	2/8	1·43
Good Oat Straw - - -	2	13	0	8	2	5	17·0	2/8	1·43
Good Clover Hay - -	5	9	1	4	4	5	32·0	2/8	1·43
Vetch and Oat Silage - -	2	1	0	8	1	13	14·0	2/4	1·25

* * * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	Price per ton				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	14.10	14. 5	13.10	13.12	17. 7
„ „ Lime (N. 13 per cent.)	...	...	...	12. 5	18.10
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
„ „ „ neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.)	...	..	...	2. 0	3. 2
„ (Pot. 14 per cent.)	2. 5	2. 1	2·12	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.) ...	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	9.10	8.10	8. 0	8. 5	3. 4
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11.15	4.11
Basic Slag (T.P. 30-32 per cent.)	3.15§	...	...	3.17§	2. 6
„ „ (T.P. 26 per cent.)	...	2.12§	...	...	...
„ „ (T.P. 24 per cent.)	...	2. 8§	2. 7§	...	...
„ „ (T.P. 20-22 per cent.)	2.12§	2. 5§	...	2.15§	2. 7
„ „ (T.P. 16-18 per cent.)	2. 2§	...	2. 0§	2.11§	3. 0
Slag Phosphate (T.P. 60 per cent.) ...	6. 7§	...	..	6.15§	2. 3
„ „ (T.P. 50 per cent.) ...	...	...	...	5.15§	2. 4
„ „ (T.P. 40 per cent.) ...	4. 7§	...	...	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	4. 0	2. 3
„ (S.P. 30 per cent.) ...	3.17	3. 7	3.15§	3.12	2. 5
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 0	8.12	...
Steamed Bone Flour (T.P. 60 per cent.) ..	8.10†	7.10†	7.10	6.17	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13. 5	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

* * * * * *

THE ADVISORY SERVICE OF THE MINISTRY.

THERE have recently been made a number of appointments of Agricultural Advisory Officers at Colleges and Universities, and it will probably be convenient to farmers and others interested to have a full list of officers at the thirteen advisory centres in England and Wales. The counties served by each officer are as stated below:—

Centre.	*Counties.*	*Name of Adviser.*	*Subject.*
BRISTOL: Agricultural and Horticultural Research Station	Gloucester Hereford Somerset Wiltshire Worcester	T. Wallace, M.Sc., A.I.C. E. Ballard, B.A.	Chemistry Entomology

Centre.	*Counties.*	*Name of Adviser.*	*Subject.*
CAMBRIDGE: School of Agriculture	Bedford Cambridge Essex Hertford Huntingdon Isle of Ely Lincoln (Holland) Lincoln (Kesteven) Norfolk Northampton Soke of Peterboro' Suffolk, East Suffolk, West	F. R. Petherbidge, M.A. W. S. Mansfield, B.A. W. A. R. Dillon Weston, B.A.	Biology Chemistry Mycology
LEEDS: University Dept. of Agriculture	Yorkshire, E. Riding „ N. „ „ W. „	T. H. Taylor, M.A. J. A. Hanley, Ph.D. W. A. Millard, B.Sc.	Entomology Chemistry Mycology
MANCHESTER: University	Cheshire Lancashire	Kenneth M. Smith E. Holmes Smith, B.Sc.	Entomology Mycology
NEWCASTLE-UPON-TYNE: Armstrong Coll. Agricultural Dept.	Cumberland Westmorland Durham Northumberland	S. H. Collins, M.Sc. R. A. Harper Gray, M.A., M.Sc.	Chemistry Entomology
NEWPORT (SALOP): Harper Adams Agricultural Coll.	Salop Stafford Warwick	N. C. Preston, B.Sc.	Mycology
NEWTON ABBOT: Seale Hayne Agricultural Coll.	Cornwall Devon	W. E. H. Hodson, A.R.C.S.	Entomology
READING: University Coll.	Berkshire Buckingham Dorset Hampshire Isle of Wight Middlesex Oxford	F. O. Mosley, F.L.S. W. Buddin, B.A.	Entomology Mycology
SUTTON BONINGTON (NOTTS.): Midland Agric. and Dairy College	Derby Leicester Lincoln (Lindsey) Nottingham Rutland	A. Roebuck H. H. Stirrup, M.Sc.	Entomology Mycology
WYE: South Eastern Agric. College	Kent Surrey Sussex, East „ West	F. V. Theobald, M.A. E. S. Salmon, F.L.S. W. Goodwin, D.Sc.	Entomology Mycology Chemistry
ABERYSTWYTH: University Coll. of Wales	Brecon and Radnor Cardigan Carmarthen Merioneth Montgomery Pembroke	T. W. Fagan, M.A., F.I.C. J. R. W. Jenkins, B.Sc. D. W. Davies, B.Sc.	Chemistry Entomology Mycology

Centre.	*Counties.*	*Name of Adviser.*	*Subject.*
BANGOR: University Coll. of North Wales	Anglesey Carnarvon Denbigh Flint	G. W. Robinson, M.A. C. L. Walton, M.Sc. T. Whitehead, A.R.C.S.	Chemistry Entomology Mycology
CARDIFF: University Coll. of South Wales and Monmouth	Glamorgan Monmouth	N. Bissett, M.R.C.V.S. J. Rees, B.A., B.Sc. H. W. Thompson, M.Sc.	Veterinary Science Mycology Entomology

It will be observed that at most centres there are an entomologist and a mycologist, and it is expected that within the next twelve months this will be the case at every centre. Chemists have been appointed at six centres only, but elsewhere arrangements are generally made to supply advice which requires expert knowledge of agricultural chemistry, although no special appointment has been made. At only one centre (Cardiff) has an adviser in veterinary science been appointed, but it is proposed to provide for the appointment of veterinary advisers at other centres where the local conditions appear specially to demand it. It is not the intention that veterinary advisers should interfere with the legitimate practice of veterinary practitioners and consultants, but give advice and conduct research in subjects of public interest—epidemics or cases of high and long continued mortality in a flock or herd. This branch of the advisory service will be linked up with the Research Institutes in Animal Pathology. Another development already far advanced is the appointment of agricultural economists, who will act in the capacity of advisory officers, particularly in the matter of costings, in their districts: it is hoped that the scheme, which is not yet quite complete, will be dealt with in the May issue of the *Journal*. It may be mentioned, however, that the work will be conducted from five centres, at each of which an economist (whose name is given below) will be responsible for the scheme in the areas indicated, respectively:—

OXFORD—Institute of Agricultural Economics: Director, C. S. Orwin, M.A. (Area, west of Reading area, boundary yet to be precisely defined. The Institute will act, not only as a provincial centre, but as the co-ordinating centre of the whole scheme.)

CAMBRIDGE—J. A. Venn, M.A. (Area as in Table above.)

LEEDS—A. G. Ruston, B.A., D.Sc. (Area as in Table above.)

READING—J. S. Simpson, B.Sc. (Area to be adjusted with Oxford.)

WYE—J. Wyllie, B.Sc. (Area as in Table above.)

The Ministry's general scheme for the provision of advice is explained in Leaflet No. 279, and a number of counties and some advisory centres have issued pamphlets giving details of the arrangements in particular areas. As a rule a farmer in need of advice will first turn to the Agricultural Organiser for his

County. This officer deals at once with any questions relating to ordinary farming practice, but if the difficulty is of a specialist character, one to which no easy solution is forthcoming, or one that necessitates a little inquiry on the spot or a minor investigation of the circumstances, then it falls to be dealt with by the appropriate Advisory Officer.

It will be seen that a part of the work of these specialist Advisory Officers comes to them either directly or indirectly from the farmer who requires assistance on some specific point: but an equally important part of their work reaches them from the Research Institutes. The aim of Research Institutes is, in general, national, *i.e.*, research is carried out without special reference to locality and soil. Sooner or later, however, this research reaches a stage at which application to local conditions is required. It is, therefore, the duty of the advisory officers to interpret the work of Research Institutes in accordance with local needs, to supplement it by the investigation of local problems and to ensure as far as possible that local agricultural methods keep pace with the progress made in agricultural research.

It should be explained that as a consequence of the administrative responsibility placed on the Ministry in connection with the control of certain plant diseases, the plant pathological Advisory Officers, besides discharging the duties mentioned above, act also as the Ministry's intelligence officers.

To prevent duplication of effort in the provision of advice, it has been arranged that provincial centres will hold periodical meetings between the advisory officers and the organisers working in the area covered by a College. In this way it is hoped to ensure both an exchange of information and common action when that appears desirable in order to meet some special need that has arisen in the area. Secondly, in order to secure co-ordination between the Technical Officers of the Ministry and the Advisory Service, especially in connection with plant diseases, meetings of the Ministry's Technical Officers and the Advisory Officers are held periodically.

* * * * * *

The Agricultural Index Number.

THE index numbers of prices of agricultural produce in England and Wales show that on the whole, average prices during February were lower than in January, the increase compared with the corresponding month in 1911-13 being 68 per cent. against 68 per cent. in January. Most commodities were relatively cheaper than in January, the decline in the case of eggs being exceptionally sharp.

It has been suggested to the Ministry recently that these index figures give a more favourable impression than the position of the arable farmer really warrants. It will be understood that the average index figure takes account of the principal farm commodities, due allowance being made for the proportionate value of the different products; for instance, more weight is given to live stock and milk than to corn, because on the average the former products bulk more largely in the farmer's receipts than the latter. Individual farmers or groups of farmers may be differently affected, and it is not suggested that the index number can be regarded as accurately representing every type of farming. It is merely an average, and certain classes of agriculturists are no doubt less favourably situated than the average.

The following table shows the percentage increases in each month since January 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	—
April	202	149	70	—
May	180	119	71	—
June	175	112	68	—
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

Wheat and barley were cheaper than in January, the former declining by 3d. and the latter by 6d. per cwt., and barley was only 12 per cent. dearer than before the war. Oats continued relatively dearer than wheat or barley, and prices rose slightly, but as the rise was not so great as is usual in February the index number shows a decline. Potatoes were cheaper and sold during February at town markets at 5 per cent. below the pre-war price. Prices of hay showed little variation and town prices were 42 per cent. above those ruling in 1911-13.

Prices of fat cattle, though showing a hardening tendency during February, remained at 61 per cent. above pre-war figures. Fat sheep advanced by ½d. per lb., but this rise is relatively smaller than is usual at this time of the year and the index number is therefore reduced. Fat pigs were easier and averaged 88 per cent. more than in 1911-13. Prices of fat stock are on the whole quite as high as a year ago, pigs and sheep being dearer and cattle 6d. per 14 lbs. stone cheaper. Dairy cattle became cheaper during February, and at 67 per cent. above the pre-war price are selling at less money than in any month since September last. Store cattle remained practically unchanged at 36 per cent. above 1911-13, whilst the increases in store sheep and pig prices were relatively less than in the base years. Store pigs at two and a half times the pre-war price remain very dear as compared with the price of fat pigs.

Butter and cheese are much dearer than a year ago, prices of butter being about 20 per cent. and of cheese about 40 per cent. higher than in February 1922. The sharp rise in cheese prices since October has been due to smaller imports, but imports of butter in recent months have not been lower than in the corresponding period of last year. There has, however, been a very active demand for butter in the past few weeks. Eggs declined from an average of 2s. 4¾d. per dozen in January to 1s. 8d. per dozen in February and were very little dearer than in March of last year. In February 1922, egg prices were 82 per cent. higher than this year.

The following table shows the average increases during recent months in the prices of the principal commodities :—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922				1923.	
Commodity.	Feb.	Oct.	Nov.	Dec.	Jan.	Feb.
Wheat ...	50	24	32	32	33	28
Barley ...	49	29	34	17	20	12
Oats	48	33	38	36	43	39
Fat cattle ...	67	49	48	48	61	61
Fat sheep ...	72	90	87	81	103	97
Fat pigs ...	82	85	94	94	102	88
Dairy cows ...	†	69	74	72	74	67
Store cattle ...	†	30	29	28	36	36
Store sheep ...	†	106	93	83	105	100
Store pigs ...	†	135	148	151	171	154
Eggs... ...	166	104	98	63	86	46
Poultry ...	80	77	75	86	81	80
Milk	117	90	90	90	90	90
Butter ...	41	71	72	73	73	72
Cheese ...	33	36	55	60	85	88
Potatoes ...	122	3	8	7	—1*	—5*
Hay	32	45	45	47	43	42

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* Decrease.

† Markets for store stock were closed during the greater part of February, 1922, owing to foot-and-mouth disease.

Egg and Chick Distribution Scheme, 1923.

This scheme is now in operation in the majority of counties in England and Wales. Its object is to provide facilities for cottagers, and other individuals who are engaged in poultry-keeping in a small way, to obtain stocks of fowls of good productive capacity from approved breeders in their district. It is designed particularly to help beginners in poultry-keeping. The larger poultry-keeper is, as a rule, fully aware of the importance of using only the best stock, both for egg-production and for table purposes. The small man or the beginner needs to have the advantages of it brought home to him. The scheme has been in operation for several seasons throughout the country, and it is hoped that before many years are over the productive quality of our ordinary poultry stock will have been considerably improved by its help.

That there is a large field for the further development of the poultry industry in this country is evident from the fact that in each of the last three years over £15,000,000 worth of eggs and poultry has been imported into the United Kingdom from countries abroad, most of which remains in Great Britain, whilst there is a large amount (16 million pounds worth in 1920, and 11 million pounds worth in 1921) imported into Great Britain from Ireland.

The details of the scheme include the approval of a breeder of poultry in each district as a "station-holder," from whom eggs and chicks may be bought. Before approval is given, his premises have to satisfy inspection by the County Poultry Instructor. It is an essential condition of this scheme that the eggs and chicks are sold by him to cottagers, etc., at specially favourable prices, which are fixed by the county authorities. The distribution of eggs under the scheme finishes on the 15th May, and that of chicks on the 31st May. Small poultry-keepers who have not done so already should make a point of taking advantage of the scheme, and if they find themselves in difficulties about it, they should send to the Ministry of Agriculture for leaflet No. 389, which will give them all the information they are likely to need.

* * * * * *

Weevil Infested Garlic.

The following note has been received from Mr. Charles Mosley, M.B.O.U., Assistant Curator of the Huddersfield Municipal Museum:—

"Some time ago a large consignment of 'Spanish' garlic was received by a Yorkshire house of wholesale druggists, which proved to be infested by a weevil. I submitted specimens to the British (Natural History) Museum, and received the information that the name is *Brachycerus cinereus*.

The same firm has for years imported garlic in great quantity but neither before nor since has any of it been affected in this way. This particular consignment was alive with the weevils —all in the imago state, for in the portion that I examined I failed to detect either larvæ or pupæ. The fact that *Brachycerus cinereus* will attack garlic presents an economic proposition against which users of that and similar commodities need to be on their guard."

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Redemption of Lay Tithe Rentcharge.

FROM correspondence received by the Ministry, it would appear that many landowners are under the impression that the terms on which lay tithe rentcharge can be redeemed under the Tithe Act, 1918, at the present time are higher than those for cases in which application was made under the Act on or before 1st January, 1921. The Ministry desires, however, to point out that, although for the purposes of redemption the " gross annual value " of tithe rentcharge is now 104 per cent. as compared with 100 per cent. before 2nd January, 1921, and the number of years' purchase of the net annual value taken as the amount of the consideration for redemption is now 22 instead of 21, the cost of redeeming lay tithe rentcharge is, as a rule, much less now than in 1920. This is due to the fact that, in arriving at the net annual value of tithe rentcharge for the purpose of calculating the amount of the consideration money for redemption, it is necessary for the Ministry to deduct from the " gross annual value," *inter alia*, the average amount paid or payable by the titheowner in respect of the rentcharge on account of rates during the three years immediately preceding the date of the application to redeem. In this connection it may be noted that the average of the rates paid or payable by lay titheowners for the three years, 1920, 1921 and 1922, is in most parishes considerably higher than the average for the three years preceding 1920. Where the application is made at the present time, the consideration money, calculated as prescribed by the First Schedule to the Tithe Act, 1918, works out in an average case at approximately 12¾ years' purchase only of the present value of lay tithe rentcharge, as compared with 15 years' purchase in 1920. It is to be observed that lay tithe rentcharge includes tithe rentcharge payable to the Ecclesiastical

Commissioners, Colleges and Municipal Corporations, as well as tithe rentcharge payable to individual lay owners.

Forms and instructions as to redemption procedure are supplied by the Ministry on request.

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Sainfoin—Advantage of Using Milled Seed.

THE Ministry considers that it is desirable to draw attention to the fact that the use for seed purposes of milled sainfoin has advantages over the use of sainfoin in husk. In some districts there may be a prejudice against the use of milled seed, the opinion being held that stocks of the old common sainfoin are more likely to be genuine if obtained in the husk. There does not, however, nowadays appear to be any grounds for this belief. Evidence that has accumulated during the past five years at the Official Seed Testing Station shows that higher purity and germination will usually be obtained from milled than unmilled seed.

The purity of sainfoin in husk is on the average one or two per cent. lower than that of milled seed. Moreover, the nature of the impurity is different. It is difficult entirely to eliminate brome grass, burnet or similar large seeds from unmilled sainfoin, whereas the impurity in the milled seed consists usually of broken fragments of seed.

Unmilled sainfoin always contains a small proportion of husks which are either entirely empty or which contain partially developed seeds. These would be eliminated by milling. Also a healthy seed may have great difficulty in breaking through the husk and may die in the process. It will be clear, therefore, that, other things being equal, a milled sample of seed will have a higher germination than the same sample in husk.

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Conciliation Committees in Agriculture.

THE Ashby Bosworth Committee has agreed on the payment of adult male workers at the rate of 31s. for a week of 54 hours with overtime at 7d. per hour on weekdays and 10d. per hour on Sundays. The agreement will operate until one month after notice of any revision is given by either side of the Committee.

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The Devonshire Committee has reached a further agreement providing for payment to adult male workers at the rate of 30s. for a week of 51 hours, with overtime rates of 8d. and 10d. per hour for weekdays and Sundays respectively. The agreement includes rates for male workers under 21 years of age and is operative from 25th March to 29th September. Provision is also made for one short day in every week.

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AGRICULTURE ABROAD.

CONDITIONS OF COUNTRY LIFE AND WORK IN FRANCE—ELECTRIC SILAGE—ACT EXTENDING INDUSTRIAL ACCIDENT LEGISLATION IN FRANCE.

Conditions of Country Life and Work in France.

THE Report of the Finance Commission of the French Chamber given in the *Journal Officiel* (14th November, 1922) draws attention to the serious depletion of the countryside in France by the continuous movement of agricultural workers to the towns. The causes, the Commission considers, should not be regarded as uniform, although one of the chief reasons is undoubtedly the attraction of high wages in the towns. It is thought unlikely, on the other hand, that the 8-hour day of industrial workers can hold any strong inducement for migration, as the average day of an agricultural labourer, taken the whole year through, consists of only 8 working hours. It is, however, admitted that "the agricultural worker is less well treated and leads a less agreeable life than the worker in the towns."

Both the farmers' and the workers' representatives have offered schemes for improving the situation of the agricultural worker. The workers suggest that an attempt should be made to stabilise wages, having regard to the cost of living, at a level equivalent to that in industry, and that equal pay should be given for equal work. Hours of work should be regulated on the basis of 8 hours a day with a maximum of 10 hours. They urge that every means should be taken to prevent accidents at work, and where accidents occur adequate compensation should be given. The improvement of accommodation, board and lodging, and the abolition of the present insanitary conditions of working and living are regarded as essential. With regard to unemployment it is proposed to introduce improved methods of cultivation, with better machinery and the constitution of mobile corps of workers, and to organise labour exchanges under joint control. The workers also claim that the growing number of collective agreements and treaties warrant a system of labour inspection by the Ministry of

Labour, and that these inspectors alone should be competent to intervene in the supervision of agreements.

The farmers give their view that it is necessary to increase output in order to increase wages, and recommend schemes which, in their opinion, will effect this object. They propose that municipalities should be empowered to improve country roads, and that drainage and irrigation schemes should be encouraged. In order to train the youth to become an efficient worker it is suggested that rural classes should be introduced in elementary schools, and that the training should be continued on apprenticeship farms. The employers advocate that the basic wage in agriculture should be defined, but oppose the limitation of the working day. In order to facilitate access to the land a system is offered to bring owners and workers together; at the same time questions of remuneration might be settled.

These resolutions correspond only on matters of secondary importance, although each bears evidence of the desire to improve the position of the agricultural worker.

Two Bills have recently been introduced in favour of agricultural workers. The first proposes compensation for farmers' sons when they remain at work with their parents, and also for persons over 25 years upon leaving the farm, if they have worked or lived with their parents for at least 5 years without enjoying the position either of partner or ordinary paid worker. The second Bill, which is well supported, proposes to retain workers on the land by the conversion of all large farms which are inadequately cultivated into small family properties.

The report suggests that it would also be useful to assist with credit schemes to provide working expenses, without which a smallholder finds himself in a most difficult position.

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Silage Cured by Electricity.

A PROCESS for the curing of silage by electricity has been invented by Th. Schweizer, of Dresden, and is being worked in Switzerland by the Oerlikon Machine Factory.*

The green forage, just as it is mown, is chopped up and placed in a cement receptacle. It then lies between two electrodes and is heated to about 120° F. by the electric current. According to the patentees this passage of the electric current kills the vegetable cells and the bacteria of the forage, the resulting product being of perfect quality, keeping well, and suffering no loss.

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* *See Bulletin de l'Office Vétérinaire et de la Division de l'Agriculture (Switzerland), XXIII an. No.* 19. *Berne* 15 *Mai*, 1922.

In an experiment 14 tons 18 cwt. 45 lb. of green forage was tested electrically and produced 11 tons 15 cwt. 87 lb. of silage (79 per cent.). The material was put in the silos between 24th September and 1st October, and was taken out between 27th December and 15th January.

Feeding trials were carried out with twelve dairy cows in which the "electric silage" was tested against ordinary silage. The live weight of the animals varied very little during the feeding period. As regards milk, after making adjustments (including allowance for waning lactation) the yield during the "electric silage" period is stated to have shown an increase per head per day of about ⅗ lb. The material was not liked by the cows. The milk was only used for making Emmenthal cheese.

The results of the trial of this silage and of trials of ordinary silage showed that silage of any kind caused serious disturbances in the manufacture of Emmenthal cheese. These troubles are caused by the fact that gas-producing butyric acid bacilli are present in the excrements and pass thence into the milk.

The general conclusions were, shortly, as follows:—The claims of the patentees were not borne out by the experiments. The practical introduction of the process, even allowing liberally for the advantages which the experiment has established, would still meet with great difficulties both economical and practical. The installation in Switzerland of electric silos cannot at present be recommended.

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Industrial Accident Legislation in France.

THE "*Journal Officiel*," of the 16th December, 1922, reports the definite adoption by the French Chamber of the Bill for extending industrial accident legislation to agricultural undertakings. The Act of 1899 contains regulations concerning accidents arising from the use of agricultural machinery driven by stationary motors, but otherwise agricultural workers had no special guarantee against occupational risks.

The new Act provides that legislation concerning the responsibility for industrial accidents shall, in principle, cover both manual and non-manual workers and domestic servants (except those employed exclusively on personal services to the employer) employed in agricultural undertakings of any kind, including undertakings for the breeding and training of animals, storehouses, or sale rooms, etc., connected with an agricultural undertaking if the latter is the main undertaking.

The scope of the Act does not extend to undertakings worked by the owners alone or with the assistance of their families and relations even if outside labour is occasionally employed, but special insurance policies can be obtained for these cases. Foreign workers who do not reside on French territory are not entitled to the daily benefits applicable in the case of accident unless reciprocal treatment is provided by international treaty.

The Act will come into operation one year after the publication of the administrative decrees for its application which must be issued within six months of the promulgation of the Act.

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Foot-and-Mouth Disease. *Gloucestershire.*—A further outbreak occurred in the Gloucestershire area referred to in the last issue of the *Journal*, disease being confirmed on 20th February at Bourton-on-the-Water, seven miles from Northleach. This necessitated an extension of the prohibited area but there has been no further development since that date, and the prohibition of movement restrictions now apply only to two small areas in the vicinity of the outbreaks at Northleach and Bourton-on-the-Water.

Derbyshire.—On 6th March, disease was found to exist on premises at Holymoorside near Chesterfield, four cows being affected out of a total stock of twelve cattle and seven pigs. The usual restrictions were imposed in respect of the area within a radius of fifteen miles of the infected place. No origin can be assigned for the outbreak, from which there has up to the present been no spread. The area under restrictions has now been reduced to one of approximately five miles from the infected premises.

Rabies in Ireland. Dogs from Ireland to undergo Quarantine.—In view of the confirmation of the existence of Rabies in a cat at Newcastle, Co. Down, Ireland, the Ministry has issued an Order, the effect of which is to apply the provisions of the Importation of Dogs Order of 1914, and the Importation of Dogs (Amendment) Order of 1918 (No. 2) to all dogs imported into Great Britain from Ireland.

These Orders prohibit the landing of imported dogs in this country except with a licence of the Ministry and then only on the condition that the dog is removed forthwith to veterinary premises approved by the Ministry and specified in the licence, for detention and isolation thereon for a period of six calendar months.

The Order applies to all classes of dogs and no exception therefrom can be made. Full particulars of the regulations and copies of the prescribed form of application can be obtained on application to the Secretary, 4, Whitehall Place, London, S.W.1.

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QUESTIONS IN PARLIAMENT.

Land Drainage for the Relief of Unemployment.—In reply to a question by Mr. Wright, the Minister of Agriculture stated in the House of Commons on the 9th March that the Ministry had, since the 1st October last, been initiating drainage schemes for the relief of rural unemployment all over the country. Up to date, 469 schemes, exclusive of 110 water supply schemes, had been approved, and, according to the latest complete returns, for the week ending 24th February, 1923, over 6,000 men were employed. But for the recent bad weather, which has held up schemes in many places, a far larger number of men would have been at work.

Rural Telephones.—The Postmaster-General, Sir W. Joynson-Hicks, in reply to a question by Mr. Foot on the 13th March, said that since the 1st May, 1922, about 3,100 rural party line subscribers had been connected with the system and 85 exchanges and about 650 call offices had been opened in rural areas. In addition, a large number of exchanges and call offices were in course of completion.

Land Settlement.—In reply to a question asked in the House of Commons on the 5th March by Mr. Short, the Minister of Agriculture made the following statement:—

"The total number of ex-service men and others who have been settled on small holdings or upon the land in England and Wales since the inauguration of the Land Settlement Scheme is 19,112, in addition to which it is estimated that a further 1,422 will ultimately be settled on lands already acquired for small holdings but not yet equipped. The net total cost of acquisition of lands to date, including purchase price and legal expenses, etc., is approximately £9,965,000, and the estimated total cost of equipping the land is about £5,917,000. I have no complete record up to date of the number of settlers who have failed, but it is believed that the proportion of failures on the schemes provided by local authorities is not more than 5 per cent. The bad seasons and the agricultural depression have, unfortunately, placed smallholders, in common with all agriculturists, in an exceedingly difficult position, but, although it is too early to draw any general conclusion, the present indications are that the majority of the men settled will succeed in making a satisfactory livelihood."

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REPLIES TO CORRESPONDENTS.

White and Yellow Maize.—B.Y. asks for information as to the feeding values of white and yellow maize meal.

Reply : A note on the subject in this *Journal* (August, 1922, p. 473) refers to American experiments, which tended to show that when white maize is fed the remaining ration should contain a sufficiency of the fat-soluble A Vitamin.

Another correspondent was referred, for an account of these experiments, to Wisconsin Experimental Station Bulletin No. 339 (Annual Report of the Director, 1920-21) and to Hoard's Dairyman, May 5th, 1922.

Requirements of Dairy Cows.—C.X. wishes to know acreage required, quantity of roots, and feeding generally for a cow.

Reply : A copy of Leaflet No. 388 on the Feeding of Dairy Cows was sent and correspondent informed that on an average mixed farm a dairy cow requires per annum :—1½ acres pasture, 3 cwt. hay, 27 cwt. straw, 85 cwt. roots and 17 cwt. cake and corn.

Palm Kernel Meal.—D.W. asks the difference between palm kernel cake meal and palm kernel meal.

Reply : Palm kernel cake meal is ground palm kernel cake, whereas palm kernel meal is the product resulting from benzine-extracted ground palm kernels. As a food for pigs it is best to use palm kernel cake meal.

Cod Liver Oil.—E.V. asks for information as to feeding cod liver oil.

Reply : The use of cod liver oil for calf rearing is referred to in Leaflet No. 142. With cattle it should be remembered that the total fat ration should not exceed 1 lb. daily for every 1,000 lb. live weight. Accordingly, if cod liver oil is fed, regard must be had to the amount of oil which already forms part of the ration.

Lucerne Growing.—F.U. asks about Lucerne and says that the usual method in the district (borders of Essex and Herts) is to drill in rows 6 in. apart on top of winter corn in April.

Reply : Leaflet No. 160 recommends, as a general rule, sowing without a nurse crop. It is essential, of course, that the land be thoroughly clean, and if this condition be fulfilled, there should be no objection to the local practice being continued. Many growers in Essex, however, prefer to sow the crop alone in July after an early summer fallow.

Tobacco in Great Britain.—G.T. asks about tobacco growing in this country.

Reply : Experiments, first instituted in 1911 in 27 counties, have shown that a class of leaf suitable for blending can be produced in England. Climatic conditions suggested that pipe or cigar tobacco of the French type would be the easiest to grow. Trials proved this to be correct, but it was found that a higher price could be obtained for bright tobacco, and curing experiments were instituted to determine whether this could be produced. It had formerly been thought impossible to produce bright tobacco in a northern climate, but the experiments were, from a technical point of view, successful, although financially little can be said at present.

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NOTICES OF BOOKS.

Farm Lands Available for Settlement.—(48 pp.) U.S. Department of Agriculture : Farmers' Bull. No. 1,271.) This bulletin gives particulars of the various parts of the United States where farm lands are still open for settlement and summarizes some of the more important facts concerning them with a view to supplying the prospective settler with initial information regarding the conditions he may expect to meet, the types of farming prevailing in the different districts and the agencies to which he may apply for further guidance. The conclusion is that "the undeveloped land now available for settlement in the United States can be brought under cultivation only at gradually increasing cost and effort, and in many cases with comparatively small returns from the land itself. The era of free first-class land in the United States has passed, and with its passing has come an increase in the value of all land. The prospective purchaser in a developed region pays a higher money value for his farm than formerly. The prospective settler in an undeveloped region takes relatively poorer land, works longer to acquire ownership, and in many cases must be content with a less productive farm than was the case with the earlier settlers. However, as population increases, the demand for improved land will inevitably call for the development of large portions of the land now lying idle. The settler first on the ground has the choice of the best land remaining."

Texas Agricultural Experiment Station.—Bull. 295: Correlation between External Body Characters and Annual Egg-Production in White Leghorn Fowls. (14 pp.) Brazos County, 1922. In view of recent criticisms of the methods of judging at Utility Shows and the present controversy on the merits of the handling system, this bulletin is particularly interesting. One hundred and twenty-eight S.C. White Leghorn Pullets of similar breeding hatched in February and March, 1920, constituted the stock used in this study. The egg-production of each bird from 1st October, 1920, to 30th September, 1921, was recorded. At the end of this laying period the birds were weighed; measurements were taken of the length of keel, width of pelvic arch, capacity (measurement from one pelvic bone to end of breastbone), and depth of body; observations were made on the colour of the shanks and beak, pliability of pelvic bones, and handling quality (texture of skin); and the number of primary wing feathers moulted was determined. The tabulated results are stated to show a large correlation between annual egg-production and the physiological characters. The anatomical characters (weight of fowl, width of pelvic arch, capacity, depth of body, and length of keel) show no distinctly significant correlation with annual egg-production. The conclusion drawn by the author is that "in common culling practices, much more emphasis should be placed upon the physiological characters than upon the anatomical ones."

An Investigation into the Frequency and Relative Importance of the most Important Weeds in Sweden. (A Report by Mr. Pehr Bolin, Chief Assistant of the Department for Plant Cultivation of the Swedish Agricultural Experimental Station.)—The Department has made an investigation into the occurrence and importance of the various weeds in different parts of the country. The investigation has been carried out mainly by means of inquiry forms which have been distributed to a great number of farmers throughout Sweden, generally five farmers at least in every parish. The answers have been grouped according to a division of the country into geographical squares, each of 64 square miles (Swedish miles). Further, calculations have been made as to the occurrence of each of the different weeds and their injurious influence in the several regions. On the basis of this calculation, a map has been drawn up for each of 38 separate weeds, with the regions marked in 10 different colours according to the occurrence and relative importance of the weeds. Thus, on these maps each region has a colour corresponding to the information, given in the answers, regarding the occurrence of some special weed in that part. The author's own observations and investigations in different parts of the country have also to some extent served as a guide in deciding the colours of the maps.

Based upon these investigations an approximate estimate of the relative importance of the different weeds has been made in two tables. These are calculated on the average for (1) the whole country; (2) the South of Sweden; (3) Middle Sweden; (4) the lower part of Norrland; (5) the upper part of Norrland; and (6) the eastern and western parts of the South and the Middle of Sweden.

The tables show that the same plant plays a very different rôle as a weed in various parts of the country. *Cirsium arvense* (Creeping Thistle) and *Tussilago Farfara* (Coltsfoot) are, for instance, still of comparatively small importance in the upper part of Norrland, where, on the other hand, for example, *Spergula arvensis* (Spurrey), *Stellaria media* (Chickweed) and *Ranunculus repens* (Creeping Buttercup) occur comparatively more frequently than in the rest of the country. *Taraxacum officinale* (Dandelion) is a worse weed in the eastern than in the western provinces of the middle and southern parts of Sweden, whereas *Rhinanthus major* (Yellow Rattle) and *Chrysanthemum segetum* (Corn Marigold) are most numerous in the western parts.

In commentaries to each map the author discusses the probable reasons for the differences in the occurrence of the same species of weed.

A Milk Goat for Every Backyard.—(Special Pubn. No. 27, Californian Department of Agriculture, Sacramento.) The preface states that this booklet is published to meet a demand, and that since 1910 the number of milk goats in the United States has increased from 8,000 to well over 100,000. The State Department of Agriculture suggests that the man of little means may own one or two goats and that by so doing his family will gain by using more and better milk.

In California the Authorities in most towns realise the need of greater consumption of milk, and place no restriction, save simple sanitary ones, on the keepers of goats up to two in number. Three or more goats constitute a dairy, in which case a permit is needed and rules governing the sale of milk must be observed. Advice on the purchase of goats is given in the booklet. Plans and details are given of a goat dairy and house to hold two goats and their food, and also a diagram of a new type of hay rack for feeding two goats without waste. Methods of keeping milk clean, and of sterilization and cooling, suitable for goat dairies, are explained.*

1. **Alimentation Rationnelle des animaux domestiques** (403 pp.). 2. **Les aliments du bétail** (356 pp.). (Raoul Gounin. Paris: J. B. Bailliere et Fils, 1922). 10 francs each. These two volumes constitute an important contribution to the general agricultural literature dealing with the nutrition of farm animals. In the first volume, the author deals with the different scientific feeding systems, and then proceeds to deal in detail with the nutritive value of all feeding stuffs in general use in French agricultural practice. The latter half of the first volume deals with the general effects of poisons introduced through feeding stuffs, and the common poisonous plants.

The second volume begins with a general treatise on animal nutrition, and is followed by practical advice on the feeding of horses, calves, milch cows, bullocks, sheep, goats and pigs. For those who can read French and who wish to extend their knowledge of feeding methods, these books may be strongly recommended.

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* [For information on goat keeping in England see Leaflet 306, The Goat as a Source of Milk; Leaflet 383, Hints on Goat Keeping; Plans of a Goat House, price 3d. post free. From the Ministry of Agriculture, Whitehall Place, S.W.1.]

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Aberdeen and North of Scotland College of Agriculture.—The Rowett Institute, Bucksburn, Aberdeen. [Origin, Development and Nature of Institute, Description of Buildings and Lands, and First Report on Work covering the period April—October, 1914 and 1919-22.] (94 pp.) Aberdeen, 1923, 1s. [37(072).]

Orwin, C. S.—Farm Costing and Accounts. (31 pp.) [Successful Farming Series.] London: Benn Bros., Ltd., 1923, 1s. 6d. net. [657(04).]

Rhode Island Agricultural Experiment Station.—Bull. 188:—The Substitution of Stable Manure by Fertilizers, Green Manures and Peat. (23 pp.) Kingston, 1922. [63.16(04).]

International Seed Testing Conference.—Report of the Discussions at the Third International Seed Testing Conference, Copenhagen, June 6-10, 1921. (135 pp.) Copenhagen: Conference Press, 1922. [63.1951.]

Field Crops.

Australia Institute of Science and Industry.—Bull. 23:—A Classification and Detailed Description of the Oats of Australia. Being the Third Report of the Special Committee on Seed Improvement. (31 pp.) Melbourne, 1922. [63.314.]

Piper, C. V., and *Morse, W. J.*—The Soybean. (329 pp.) New York and London: McGraw-Hill Book Co., Ltd., 1923, 20s. net. [63.321.]

University College of North Wales.—i. Experiments with Oats, 1922: (*a*) Varieties; (*b*) Test of "Corn Covers." ii. Production of Seed Oats in North Wales. (15 pp.) Bangor, 1923. [63.314; 63.198.]

University of Leeds and the Yorkshire Council for Agricultural Education.—Bull. 126:—Variety Trials of Potatoes in Yorkshire, 1922. (4 pp.) Leeds, 1922. [63.512(04).]

Gilchrist, D. A.—Seeds Mixtures and the Improvement of Grass Land. Being an address delivered at the Plymouth Show of the Bath and West and Southern Counties Society, 1922. (12 pp.) Bath: Herald Press, 1922. [63.33(*a*).]

Miln, G. P.—The Romance of Wild White Clover. (8 pp.) Notes on Wild Red Clover. (4 pp.) Home-Grown Grass Seeds. Second Edition. (8 pp.) Warrington: Gartons, Ltd., 1923. [63.31(*b*); 63.1951.]

Horticulture and Fruitgrowing.

Allen-Brown, A. & D.—The Violet Book. (94 pp. + 10 coloured plates.) Taunton: Barnicott & Pearce (Wessex Press), 1922, 6s. 6d. post free. [63.52.]

Gardner, V. R., Bradford, F. C., and *Hooker, H. D.*—The Fundamentals of Fruit Production. (686 pp.) New York and London: McGraw-Hill Book Co., 1922, 22s. 6d. [63.41(02).]

Plant Pests and Diseases.

U. S. Department of Agriculture.—Farmers' Bull. 1270:—The More Important Apple Insects. (95 pp.) Washington, 1922. [63.27-41.]

Cornell Agricultural Experiment Station.—Bull. 410:—Studies on Insects Affecting the Fruit of the Apple, with particular reference to the Characteristics of the resulting Scars. (pp. 447—498 + plates iv—xlii.) Ithaca, 1922. [63.27-41.]

Roebuck, A.—Insect Pests and Fungus Diseases of Farm Crops. (55 pp.) [Successful Farming Series.] London: Benn Bros., Ltd., 1923, 2s. net.

Wageningen Landbouwhoogeschool.—Mededeelingen, Deel 26, Verh. 1:—A Study into the Literature on Stipple-Streak and Related Diseases of Potato. (52 pp.) Wageningen, 1922. [63.23.]

Live Stock and Feeding Stuffs.

Potts, H. W.—Pigs and their Management. Fourth Edition Revised. (230 pp. + 76 plates.) Sydney, N.S.W.: Angus & Robertson, Ltd., 1923, 12s. 6d. [63.64(02).]

Lovejoy, A. J., and *Evvard, J. M.*—Hogs: A Practical Book for the Pure Bred Swine Breeder and Farmer. (212 pp.) Chicago: Frost Publishing Co.; South Godstone, Surrey: T. A. Stephens, 1919, 5s. 6d. [63.64(02).]

Halnan, E. T.—Animal Nutrition. (52 pp.) [Successful Farming Series.] London: Benn Bros., Ltd., 1923, 2s. net. [63.6043(04).]

University of Leeds and the Yorkshire Council for Agricultural Education.—Bull. 73 (Sixth Revision) :—Composition, Nutritive and Manurial Values of Farm Foods. Leeds, 1923. [63.60433.]

Dairying.

Cornell Agricultural Experiment Station.— Bull. 409 :—An Economic Study of Dairying on 149 Farms in Broome County, New York. (271—443 pp.) Ithaca, 1922. [63.7(73).]

New York Agricultural Experiment Station.—Technical Bull. 89 :—Review of the Bacteriological Aspects of Cheese Ripening, with Bibliography. (36 pp.) Geneva, 1922. [576-8 : 7.]

National Milk Conference.—Report of the Proceedings of the National Milk Conference held in the Council Chamber of the Guild Hall on October 16th, 17th and 18th, 1922. (222 pp.) London : National Clean Milk Society, 1923, 3s. [63.71 ; 614.32.]

Veterinary Science.

University of Leeds and the Yorkshire Council for Agricultural Education.—Bull. 127 :—Parasitic Gastritis or "Drying" in Lambs. (11 pp.) Leeds, 1923. [619.3.]

Wisconsin Agricultural Experiment Station.—Research Bull. 55 :—An Experimental Study of Infectious Abortion in Swine. (35 pp.) Madison, 1922. [619.4.]

Poultry and Bees.

Hooley, Will.—Poultry-Craft. A Manual for Instructors, Students and all Poultry Keepers. Being an Exposition of Applied Science Combined with Practical Experience as Relating more especially to the Utility Problems of Poultry Culture (excluding Bantams and Caponising.) (xix + 473 pp.) London : Poultry Press, 1923, 15s. net. [63.65(02).]

Brown, Edward.—Poultry Keeping on the Farm. (54 pp.) [Successful Farming Series.] London : Benn Bros., Ltd., 1923, 2s. net. [63.65(04).]

Punnett, R. C.—Heredity in Poultry. (204 pp.) London : Macmillan & Co., 1923, 10s. net. [575-1; 63.65(02).]

Edwardes, Tickner.—Bee-Keeping for All : A Manual of Honey-Craft. (136 pp.) London : Methuen & Co., 1923, 3s. 6d. net. [63.81(02).]

Machinery.

University of Leeds and the Yorkshire Council for Agricultural Education.—Bull. 125 :—The Use of Implements in the Lifting of the Potato Crop, 1921. (87 pp.) Leeds, 1922, 2s. 6d. [31.17(04).]

Deutsche Landwirtschaft-Gesellschaft.—Arbeiten 320 :—Hauptprüfung der Kleindrillmaschinen Bodenbearbeitungsgeräte für Wein-und Obstbau Kartoffelsichtmaschinen. (88 pp.) Berlin, 1922. [63.17(04).]

Bond, J. R.—Farm Implements and Machinery. (282 pp.) London : Benn Bros., Ltd., 1923, 35s. net. [63.17(02).]

Highland and Agricultural Society of Scotland.—Demonstration of Farm Tractors and Tractor Implements at Fordel, Dalkeith, Midlothian, October 17th—20th, 1922. (74 pp.) Edinburgh and London : W. Blackwood and Sons. [63.175(04).]

Economics.

Strickland, C. F.—Studies in European Co-operation. (166 pp.) Lahore : Government Printing : London : Constable, 1922, 4s. 8d. [334(4).]

Darling, M. L.—Some Aspects of Co-operation in Germany, Italy and Ireland. Lahore : Government Printing ; London : Constable, 1922, 5s. 3d. [334(415) ; 334(43) ; 334(45).]

Macklin, T.—Efficient Marketing for Agriculture : its Services, Methods and Agencies. (418 pp.) New York and London : Macmillan Co., 1922, 12s. 6d. [381.]

Smith, J. G.—Organised Produce Markets. (238 pp.) London : Longmans, Green & Co., 1922, 12s. 6d. net. [381.1.]

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**Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W. 1.**

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXX. No. 2.

MAY, 1923.

NOTES FOR THE MONTH.

Agricultural Policy of the Government.

1.—THE following statement with regard to the decisions of the Government as to the Report of the Tribunal of Economists was issued by the Minister of Agriculture on 11th April:—

In view of the short time since the Report was issued and the importance, financial and otherwise, of the questions involved the Government are not prepared to make any comprehensive statement at the present time.

With regard to railway rates the Government are of the opinion that the Railway Companies are in a position to reduce rates drastically. The remedy, however, lies in the hands of the industry itself, which can make an application to the Railway Rates Tribunal established by Parliament for such cases. In this connection meetings between the parties are being arranged, and the Ministry of Agriculture has expressed its willingness to give any assistance in its power.

With regard to hops the Government does not adopt the recommendations of the Tribunal. A little time will be necessary to ascertain what will be the probable future consumption of beer. The present control will continue till 1925. The Government recognises the claims of the hop-growers and before the expiration of the control will deal with the question.

With regard to local rates it has been decided that the Road Fund surplus, amounting probably to over £1,250,000, should be devoted to relief of rates for the upkeep of rural roads. The Government also intends, pending proposals for dealing with the whole rates question, to introduce a bill this Session to reduce the assessment of agricultural land from one-half to one-quarter, making good the difference by an Exchequer grant. This would be in addition to the proposal as to the Road Fund.

2.—A further statement was made to representatives of the Press by the Minister on 17th April. Sir Robert Sanders said that in the first place the Government proposed to hand over from the surplus of the Road Fund a sum of between £1,250,000 and £1,500,000 for the relief of the rates for the upkeep of rural roads. In addition the Government intend, pending proposals for dealing with the whole rating question, to introduce a Bill this Session to reduce the assessment of agricultural land for rates from one-half to one-quarter, making good the deficiency by an Exchequer grant. This, the Minister said, is the biggest concession to agriculture for a generation. It means that on an assessment of £100, with a rate of 11s. 6d. in the pound, a farmer will receive a relief of £14 7s. 6d. The total amount for England and Wales that will be covered by this Exchequer grant is £2,750,000, which, together with the grant of £1,300,000 which is still being paid under the Agricultural Rates Act of 1896 will make a total grant of over £4,000,000 per annum.

With regard to railway rates for agricultural produce he reminded farmers that the Railway Rates Tribunal was set up in November, 1921, and from that moment any agriculturist or body of agriculturists who had a grievance was entitled to bring it before the Tribunal. The attitude of the Government is that it is not prepared to adopt the suggestion made in the report of the economists that the Government should take the financial responsibility of a reduction, because it considers that the financial responsibility ought to fall on the railway companies and not on the Government.

The Minister then discussed the question of the Hop Control. He said that since 1917 hops have been controlled. At the present moment there is a large surplus of hops in hand, amounting to about half a million hundredweights. The reason for this excess is, shortly, that the Hop Control Committee expected the consumption of beer to be very much larger than it has been in the last two years. At the present rate of beer consumption the amount of hops required per year is 320,000 cwt. The full home crop on the present acreage is about 312,000 cwt. But the brewers insist on using foreign hops to the extent of one-sixth at least of their total consumption, so that, on this basis, the total annual supply of hops is 372,000 cwt. In other words there is a surplus of over 50,000 cwt. If the consumption of beer were increased by 50 per cent. the amount of hops required would be 480,000 cwt.

and the matter would become manageable. But if the consumption of beer does not increase it is obvious that the growers of hops in this country cannot go on producing the amount they produced last year.

The present control continues till 1925. A little time will be necessary to ascertain what is likely to be the future consumption of beer, but the Government recognises the claims of the hop-growers, and has announced that before the expiration of the control in 1925 it will deal with the question.

8.—In reply to a question in the House of Commons on 20th April, asking whether the Minister of Agriculture could make any further announcement as to the decision of the Government with regard to the Report of the Agricultural Tribunal, Sir Robert Sanders, Minister of Agriculture, made the following statement :—

In addition to the decisions already announced with regard to local rates, railway rates and hops, the Government have reached the following decisions with regard to other recommendations of the Report :—

Wheat Offals.—The Government do not accept the proposals of the Tribunal.

Malting Barley.—The Government accept the proposal that an Excise duty of 10s. a quarter be imposed on imported malting barley to be collected at the brewery, distillery or malthouse, with a preference of one-third on barley imported from the Dominions. It was part of the arrangement concluded with the brewing industry before the introduction of the Budget that this should not involve any rise in the price of beer. The Government propose to introduce a Bill dealing with the matter in the course of the present Session.

Potatoes.—The Government are not at present prepared to adopt the proposal of the Tribunal that imports of foreign potatoes be permitted only under general licence of the President of the Board of Trade.

Milk Production.—The Government are in favour of the proposals made in Paragraph 33 of the Report* and are considering how the proposed assistance can best be given.

Agricultural Wages.—The Government are not prepared to adopt the proposal for setting up six District Wages Boards. We intend, however, to introduce legislation to make compulsory the registration of agreements arrived at by Conciliation Committees.

---

* Para. 33 of the Report suggests State encouragement of the formation of depôts for collecting milk, and dealing with surplus milk.

The Budget and Agriculture.

THE Budget introduced by the Chancellor of the Exchequer on 16th April deals indirectly with agriculture. Farmers, in common with other classes, will welcome the proposed reduction of the Income Tax from 5s. to 4s. 6d., *i.e.*, on the smaller incomes from 2s. 6d. to 2s. 3d. The reduction in the beer tax will benefit agriculturists by the increased demand for malting barley and hops which should follow on account of the greater consumption of beer, while the repeal of the present duty of 4d. per gallon on some 6,000,000 gallons per annum of cider and perry should stimulate consumption in some degree and assist growers of cider apples and perry pears. Farmers who now carry on a trade by parcel post in dairy produce, eggs and other articles will be assisted by the reduction in parcel post rates of 3d. per parcel.

* * * * * *

Report on Milk and Milk Products.

THE Committee appointed "to inquire into the methods and costs of selling and distributing agricultural, horticultural and dairy produce in Great Britain, and to consider whether, and if so by what means, the disparity between the price received by the producer and that paid by the consumer can be diminished" has just issued its first Report, which deals with milk and milk products. The Report can be obtained through any bookseller or from H.M. Stationery Office, Imperial House, Kingsway, W.C.2.*

Starting from the point of production the Committee has conducted a complete investigation into the methods of distribution of milk and into the trading organisation which enables supplies to be collected from a wide area, conveyed to the centres of population and distributed in good condition from house to house. No previous examination has been made of the relation between the costs of distribution and the wholesale and retail prices, and this Report should prove of the greatest interest to all engaged either in the production or in the distribution of milk or milk products.

In addition, it has a direct interest to consumers as the Committee reaches the conclusion that the present costs of distribution are capable of reduction. The Report, in addition to reviewing and describing the whole organisation of the milk trade, deals with the possibilities of co-operation among producers, the effect of the Agreement between the National Farmers' Union and the Dairymen's Federation, the trade in butter, cheese, cream, condensed milk and milk powder, and the packing and grading of dairy produce.

---

* Cmd. 1854, price 3s. net.

An idea of the general tendency of the Report may be obtained from its concluding sentences, which are as follows:—

> "Finally, we desire to make it clear that where in the course of our Report we have found it possible to suggest reductions in the existing distributive margins we have done so solely in the interests of the progress and expansion of the industry itself. We are alive to the possibility of a considerable expansion of the dairying industry in this country, but we are also alive to the fact that any increase in the consumption of liquid milk or home-manufactured milk products can only be brought about by the willing co-operation of distributors in the direction of accepting a smaller percentage of profit on the resulting increased turnover.
>
> "In the opinion of those most competent to judge, the food-value of milk cannot be over-estimated. As already stated, its consumption per head in the United States and other progressive countries is more than double its consumption in Great Britain. It is in the national interest that its consumption should be greatly increased here. A prerequisite is, however, a wide and implicit confidence on the part of the consuming public. To this end the public should be given the fullest information as to the essential facts of the industry and should have the assurance that both from the hygienic and economic standpoints, the industry is being conducted upon sound and progressive lines.
>
> "We have already expressed our view that producers and distributors, with the co-operation of Government Departments and Local Authorities, should take every means of stimulating and encouraging the consumption not only of liquid milk but also of home-manufactured dairy produce. By efficient organisation this country can and should be made far more, if not entirely, self-supporting in its supplies of cheese, butter, condensed milk, cream and milk powder. In condensed milk, a profitable export trade is also possible. There are indeed many directions in which the industry can promote its own expansion and progress. The public demand for home produce of the first quality is undoubted, and as regards dairy produce, all concerned in the industry should feel it a reproach that, with our natural

advantages and accumulated experience, we are so dependent upon overseas supplies of these essential foods."

The Committee, of which the Marquis of Linlithgow is Chairman, consists of the following members:—

Sir Basil Mayhew, K.B.E., Mr. A. W. Ashby, Mr. Ernest R. Debenham, Dr. Charles M. Douglas, C.B., Mr. Percy A. Hurd, M.P., Mr. Rowland R. Robbins, C.B.E., Mr. R. J. Thompson, O.B.E., Mrs. Margaret Wintringham, M.P. The Secretary of the Committee is Mr. A. W. Street, and the Assistant Secretary, Mr. F. Grant, both of the Ministry of Agriculture and Fisheries.

It is continuing its investigations and will issue further Reports in due course relating to the sale and distribution of other agricultural produce, *e.g.*, fruit and vegetables, meat and cereals. The Report dealing with fruit and vegetables is expected to be ready in a month or six weeks.

* * * * * *

Reduction in Railway Rates.

AN official statement issued by the Railway Manager's Committee on 19th April shows that considerably reduced rates for the carriage of agricultural products by goods train come into effect on 1st May. In conjunction with a reduction in rates on certain other goods, the total cost to the railway companies is estimated at about £9,000,000 sterling per annum.

Goods Rates.—The new rates for agricultural products by goods train, as set out in the official statement, are :—

REDUCED FROM 75 TO 50 PER CENT. ABOVE PRE-WAR RATES.

Grain—flour, bran, sharps and other flour mill offal ; barely, oats and wheat. Other than in two preceeding groups.

Hay, clover, and straw.

Hops.

Vegetables—potatoes, carrots, turnips and mangel wurzels, E.O.H.P.

Machines and Implements.—The following articles as defined at page 226 of the General Railway Classification of Goods :—

Machines and implements, including agricultural carts and wagons.

Machines and implements in cases.

Chaff cutters, corn crushers, oil cake mills, root cutters and pulpers, and other machines for preparing food for agricultural purposes.

Harrows (iron), land rollers, clod crushers and horse gearing machinery.

Steam engines, portable, vertical, or horizontal, for agricultural purposes.

Also the following as named at page 227 of the General Railway Classification of Goods :—Hay-pressing machines, steam harrows, steam ploughs, steam plough vans, threshing machines, corn mills (portable), fitted with millstones, elevators, farm, staw sifters and cutters.

Agricultural seeds.

Brewers' grains, oil cake and cattle foods, provender.

Live stock at head rates, and/or at truck rates.
Butter, cheese, poultry (dead). eggs and fruit.

50 PER CENT. ABOVE PRE-WAR.—NO CHANGE.

Lime and limestone for agricultural purposes. Manure: town, stable and gas lime, E.O.H.P.

Passenger Train Traffic.—The new rates for passenger train traffic are:—

—	Percentage over pre-war approx.	
	Present.	New.
General parcels scale ... ... Owners' risk scale	100	70
Horses, mules, &c.	118.75	50
Calves, rams, sheep, pigs, &c., in horse-boxes ...	118·75	50
Cows and oxen in horse-boxes	75	50
Live stock (except horses, &c.), in specially constructed cattle trucks	75	50

Companies' Statement.—An explanatory statement issued officially with the statement of the revised charges points out that since the railways were released from Government control on 15th August, 1921, they have made progressive reductions in railway rates and charges as their financial position from time to time warranted.

" In addition large reductions have been made in the dues and charges at railway-owned docks.

" The foregoing reductions were estimated to cost the companies not less than £35,000,000 per annum, and the general effect has been to reduce goods train rates from 112 per cent. to 75 per cent. above pre-war level and passenger fares from 75 per cent. to 50 per cent. above pre-war. The wages bills of the railway companies are to-day about 136 per cent. above the pre-war level. Wages form about two-thirds of the total railway costs. The railways are paying on the average about 70 per cent. more for all materials they have to purchase. To-day the railways are generally not earning the same amount of net revenue as they did in 1913.

" The reductions granted in goods rates in August, 1922, and in passenger fares in January, 1923, have not resulfed in an increase of traffic sufficient to counteract the loss in gross revenue due to such reductions. The companies are therefore faced with a smaller revenue and the cost for working the increased traffic.

" The railway companies are fully alive to the necessity of bringing their charges down to the lowest possible limit, and have shown their willingness to do so by the reductions that already been made. They have further so-framed their programme as to give the greater reduction in the goods rates to those industries which appeared to need the greater consideration. With these objects in view the companies have given further consideration to the question, and especially to the views put before them by the members of the Agricultural Committee of the House of Commons, and have decided to make the further reductions now announced from 1st May, 1923. The concessions now announced are estimated to cost the railway companies upwards of £9,000,000.

" The companies have endeavoured to secure the co-operation of railway labour in order to make a larger reduction, but so far without success. Negotiations are proceeding, it being apparent that, failing some substantial reduction of expenditure due to high rates of wages and costly conditions of service, there is little prospect of further considerable changes in rates and charges. In the event of the negotiations with the railway trade unions being successful the companies will be prepared to make further reductions."

An official table of the new charges for goods train traffic other than agricultural products includes the following items of direct interest to farmers :—

—	Percentage of increase over pre-war.	
	Now.	New.
Agricultural manure, Classes "A," "B," and "C"	50	50
Returned empties	75	60
Small parcels	100	75
Cartage surcharge	9d. each end	*Nil*

* * * * * *

Agricultural Show in Sweden.

THE 22nd General Swedish Agricultural Show will be held at Gothenburg from 19th to 24th June next. It will be held in connection with the Jubilee Exhibition and Fair which will take place from May to September at Gothenburg to commemorate the 300th anniversary of the foundation of the city. The Swedish Government has expressed the hope that a party of British agriculturists will visit the show and exhibition, and at the same time take the opportunity of studying the agricultural conditions and institutions of the country. The Ministry will be officially represented and hopes to arrange for a party of

British agriculturists to accept the Swedish Government's invitation. The party will probably leave this country on 11th June.

The Swedish Government is arranging a tour including a visit to the famous Swedish seed-growing station at Svalöf and to other agricultural institutions and farms. A Swedish guide will be placed at the disposal of the party.

All breeds of livestock which in Sweden are qualified for entry will be exhibited at the agricultural show, but the most important will be Belgian horses; Friesian, Ayrshire and red-and-white Swedish cattle; Yorkshire pigs and Shropshire sheep. All of these are extensively bred in Sweden. Great interest will attach to collections of grain and seeds from the Swedish seed institutions, illustrating the latest achievements in plant breeding. There will also be demonstrations of experimental work, collections of dairy produce, agricultural machinery, etc.

* * * * * *

Worn-out Horse Traffic.

IN view of public interest in the traffic in horses between Great Britain and the Continent, it is felt to be desirable to publish in this issue of the *Journal* (see p. 175) a reply directed by the Minister of Agriculture, Sir Robert Sanders, M.P., to a letter from Miss A. M. F. Cole, of the Royal Society for the Prevention of Cruelty to Animals, and to a letter from the same lady of 5th March circulated to Members of Parliament and to the Press.

The traffic in worn-out horses has proved of some importance in the past, when it was felt to be essential on humanitarian grounds to take steps to ensure a cessation of anything amounting to cruelty in the treatment and shipment of horses. Owing to the action of the Department in the past few years the position is now quite different, the shipment of worn-out horses having entirely ceased, while the standard of fitness of other horses shipped is regarded by the Ministry as quite satisfactory. Horses unfit either to travel or to work without suffering would not be passed by the Ministry's Inspectors.

The question has been dealt with at some length in the letter under notice, in order that the present position should be made quite clear, and that any possible doubt entertained by the public as to cruelty to worn-out or other horses should be removed.

* * * * * *

Report of Machinery Advisory Committee.

THE Report of the Committee appointed to advise the Minister on testing and research in connection with agricultural machinery has now been presented. It is recommended that the Ministry should assume responsibility for the whole of the work relating to the development of agricultural machinery which has been divided into five categories, as follows:—

(1) *Series Investigations* (*i.e.*, investigations of short duration dealing with a number of machines for performing the same operation) should form a prominent part of the permanent work in connection with machinery during the next five years. Fees should not be charged to manufacturers or their agents, who should be willing to supply machines free of charge. The results should be published for general information. Series investigations should be arranged with groups of cultivating machinery, threshing machines, manure distributors, corn drills, potato planters, hedge cutting machinery and dairy appliances, etc.

(2) *Individual Tests.*—Facilities should be provided for a limited number of these tests. It is not necessary at this stage to draw up a scale of fees, but the applicant should be required to defray the whole cost except in special cases where it is considered desirable to remit all or part of the cost of testing. A Performance Certificate should be issued in every case and should show that under stated conditions (*a*) the implement had done certain specified work at a specified cost, (*b*) the condition of the implement at the end of the test, (*c*) the accessibility of working parts, replaceability and amount of wear, and (*d*) in the case of tractors or other prime movers, the horse power developed at the belt pulley and the drawbar. Performance Certificates should be published in full unless an entrant who has complied with the conditions of testing decides otherwise, in which case no use should be made of any part for advertising purposes.

(3) *Research.*—(*a*) *Investigations into the factors and principles underlying the use of various machines.*—The Ministry has determined the cost of mole draining, sub-soiling and deep tillage by various methods and has arranged to take records in order to ascertain the effects of these operations on the yield and quality of subsequent crops. Rothamsted is investigating the questions of soil tilth and the mechanical properties of the soil in relation to cultivating implements. All this work should

be continued and extended. In addition pipe draining should be investigated, and also rotary cultivation.

(*b*) *Problems arising out of series investigations.*—A commencement might be made with the more important residual problems which arose out of the Report on Potato Lifting Machinery.

(*c*) *New or improved Implements or methods for performing farming operations.*

(4) *Advisory Work including Assistance to Inventors.*—No change is recommended in the scheme of advisory work which is being carried out by the Ministry. So far as inventions are concerned, it is considered that the assistance already given by the Ministry's Technical Officers is all that the State can be reasonably expected to give and all that inventors can reasonably look for in the present financial condition of the country.

(5) *Exchange of Views between Farmers, Distributors, and Manufacturers.*—Hitherto farmers have had no organised means by which they could bring to the notice of manufacturers the kind of work on the farm which they would like carried out by machinery. The Committee consider that one of the functions of the new Advisory Committee, which it is proposed to set up to advise the Ministry generally on matters relating to agricultural machinery, should be to promote discussions between farmers, distributors, and manufacturers with regard to new or improved machines that may be needed and such important matters as the standardisation of plough fittings, etc.

(6) *Demonstrations.*—It is recommended that public demonstrations on a large scale should be regarded as business undertakings by which manufacturers can bring their goods to the notice of prospective customers and should be promoted by trade or agricultural organisations.

Two appendices accompany the Report; the first shows the work done by the Ministry since the issue of the Report of the Departmental Committee on Agricultural Machinery (Cmd. 506), and the other contains an exhaustive classification of existing machines and implements.

The Report is signed by all 29 members, but 4 append reservations to their signatures. The principal reservation is made by Mr. H. G. Richardson, who thinks that a separate Institute, attached to a University, should be set up to combine investigation and advanced teaching in agricultural engineering.

The Report has not been printed, but copies can be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

* * * * * *

The Agricultural Index Number.

THE index numbers of prices of agricultural produce in England and Wales show that, on the whole, average prices during March were slightly lower than in February owing mainly to reductions in the price of fat cattle and pigs. The increase as compared with March, 1911 to 1913, was 59 per cent., against 63 per cent. in February, 1923, and 77 per cent. in March, 1922. Average prices were therefore 10 per cent. lower than a year ago.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	—
May	180	119	71	—
June	175	112	68	—
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

There was little change in wheat prices during March, but barley declined by 6d. per cwt. and oats by 2d. per cwt. as compared with February. Barley usually becomes cheaper in the spring, so that the index number only dropped by 4 points, but this cereal sold at only 8 per cent. above the pre-war price. Oats and wheat were 36 per cent. and 27 per cent., respectively, dearer than in March, 1911 to 1913. The very large supplies of potatoes caused a further decline in values, and prices in town markets were 12 per cent. below pre-war. Hay remained practically unchanged, town prices being again 42 per cent. dearer than in 1911 to 1913.

Fat cattle declined steadily in price during March, and on the average were 3d. per stone cheaper than in February, and 54 per cent. dearer than before the war. The decline in fat pigs was even more marked, averaging 8d. per stone, and prices were therefore only 77 per cent. above pre-war, against rather more than double the pre-war price in January. Fat sheep, on the other hand, advanced by ¼d. per lb., but as this increase was relatively smaller than is usual in March, the index figure was slightly reduced. All classes of store stock became cheaper, though, except in the case of dairy cattle, the decline was not very appreciable. Dairy cows declined by nearly £3 per head, and were 58 per cent. above the pre-war price. Other store stock is usually dearer in March than in February, so that the small reductions in value this year caused appreciable drops in the index numbers. Store cattle and sheep were relatively cheaper than fat animals, but store pigs were still very dear as compared with fat pigs.

Cheese continued in short supply during March and rose to 95 per cent. above the pre-war price, but butter declined slightly. Both butter and cheese are very much dearer than in March. 1922. As a small proportion of the milk sold under the National Farmers' Union Scheme for yearly contracts was in excess of the quantities forwarded during November to February, and a few contracts in the Manchester district allowed for a reduction in price during March, the average price of milk was slightly lower than during February. The fall in egg prices, following the very sharp decline in February, was relatively less rapid than in the base years, so that the index number rose to 55 per cent. above March, 1911 to 1913. In March, 1922, eggs were 95 per cent. dearer than in pre-war years.

Norfolk Dispute.—A settlement was arrived at in the Norfolk labour dispute on 21st April, the terms being as follows:—

Agricultural Workers.

A wage of 25/- for a guaranteed 50-hour week. Any hours worked in excess of 50 to be paid for at 6d. per hour up to 4 hours per week and above 4 hours at overtime rates. The hours to be so arranged as to secure a weekly half-holiday. There is to be no victimisation.

Agricultural Wages.—It is estimated that the average weekly wage of agricultural labourers in England and Wales as a whole during March was about 27s. 10½d.

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THE INTERIM REPORT OF THE AGRICULTURAL. TRIBUNAL OF INVESTIGATION.

AN interim report* has been issued by the Tribunal of Investigation, consisting of Sir William Ashley, Professor W. G. S. Adams and Professor D. H. MacGregor, with Mr. C. S. Orwin as Agricultural Assessor, who were appointed by the Prime Minister in December last "to inquire into the methods which have been adopted in other countries during the last fifty years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labour at a living wage, and to advise as to the methods by which those results can be achieved in this country."

After briefly summarising the serious conditions with which British agriculture is faced at the present time, the report refers to the importance of maintaining the arable area as the only means whereby the pre-war level of the home production of food and the employment of labour can be assured. The Tribunal have not yet completed their examination of agricultural conditions obtaining in foreign countries and reserve for a later report their final conclusions, but they have been impressed with the large place occupied, in some of the countries which have been under review, by methods of co-operation among farmers and by agricultural education.

The Tribunal are of opinion that apart from enabling the farmer to purchase his supplies more cheaply and to get better prices for his produce, co-operation when fully organised relieves the farmer of many problems of marketing, so that he is enabled to devote himself more exclusively to the real business of farming. They consider that foreign experience shows that co-operation is a natural basis of social and educational developments in agriculture, and are of opinion that the agricultural industry in Great Britain stands in need of developments along these lines, but they recognise that co-operation must come from the farmers themselves and they approve the established practice of Government grants being made to Agricultural Organisation Societies.

Three suggestions are made in the report in regard to education and research :—(i) That the system in vogue in Scotland, of making appointments of County Agricultural Organisers through the Agricultural Colleges, would be preferable to the present English practice whereby the Organisers are appointed by the County Councils; and (ii) that the economic organisation of agriculture should have much greater attention both in the educational schemes of the Agricultural Colleges and in the programmes of work put in hand by the institutions where agricultural research is carried on; (iii) that it is a matter of first importance to extend research work in the direction of testing new systems of farm management, particularly as regards the maintenance of live stock on arable land.

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* Agricultural Tribunal of Investigation Interim Report. To be obtained through any bookseller or directly from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, price 6d.

The report contains a large number of recommendations, summarised below, on agricultural questions.

1. *Agricultural Credit.*—The Tribunal agree with the proposals in regard to long-term credit of the Committee on Credit Facilities in Agriculture, though they consider that farmers, organising for the joint handling of their products, should be able to obtain credit for the erection of buildings and purchase of plant against the security of their uncalled capital. With regard to short-term and intermediate credit, the Tribunal take the view that a more elastic system is called for than that proposed by the Committee, and to this end suggest that approved associations of farmers for purchase and sale should not be excluded from the scheme to be placed before Parliament.

2. *Railway Rates.*—An immediate and material reduction of railway rates on farm produce and farm supplies is urgently required. If the Railway Rates Tribunal are unable to make a substantial reduction in the rates charged on agricultural produce, the Government should intervene and become financially responsible for a reduction of not less than twenty-five per cent. on the existing rates.

3. *Local Rates.*—The contribution from the Exchequer should be a sum equal to half of the expenditure falling upon rural rates in the preceding twelve months instead of the sum fixed in 1896 as being at that time half the rate, and agricultural hereditaments, other than the farm houses and cottages, should pay on half rates as is the case with land.

4. *Wheat Offals.*—Importers of wheat flour should be required to import a corresponding quantity of offals and an export duty should be imposed on wheat offals of ten per cent. *ad valorem.*

5. *Malting Barley and Hops.*—A duty of 10s. per quarter on imported malting barley and a duty of 20s. per cwt. on imported hops should be imposed, and the hop control should be abolished.

In each case it is proposed that a preference of one-third should be allowed to the Dominions.

6. *Potatoes.*—The import of foreign potatoes should only be permitted by licence for specified periods after consideration of the extent of home supplies and the freedom from disease of proposed foreign imports.

7. *Sugar Beet.*—The exemption of home-produced sugar from excise duty should be continued sufficiently long to allow the experiment of producing sugar in this country to be thoroughly tested.

8. *Milk and Cream.*—The import of milk and cream should only be allowed when there is satisfactory evidence that their production and transport are subject to a standard of hygienic regulation equal to that required in this country. Imports of dried milk should be certified as free from adulteration, and as regards imports of preserved liquid milk an analysis of the contents should be plainly set out on the tins. It is also suggested that active assistance should be given to the formation of farmers' associations to deal with the collection of milk and the conversion of surplus milk into dried or preserved milk, butter and cheese.

9. *Marking of Agricultural Produce.*—Imports of agricultural produce should be clearly marked, as far as is practicable, to indicate the country of origin, and steps should be taken by the Departments of Agriculture to require misleading descriptions to be discontinued.

10. *Agricultural Wages.*—There should be established about six District Wages Boards to cover the whole of England and Wales, each with executive powers in its own area and uncontrolled by a Central Board. The Boards should confine themselves to the enactment of minimum wages and the granting of permits of exemption, and should not be regarded as fixing in effect the actual rates of pay.

11. *Relief of Rural Unemployment.*—Various suggestions are made with regard to the relief of rural unemployment, such as the development of lime burning and limestone crushing.

12. *Local Administrative Machinery.*—The desirability of improving the local administrative machinery for the purpose of advancing the organisation of the agricultural industry is urged.

Professor MacGregor makes a reservation in regard to the proposals numbered 2, 3, 4 and 5 above.

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LAND RECLAMATION:

SOME ASPECTS OF LAND RECLAMATION, WITH PARTICULAR REFERENCE TO THE ALLEVIATION OF UNEMPLOYMENT.

A. T. A. DOBSON,
Assistant Secretary, Ministry of Agriculture and Fisheries

FOR the purpose of the remarks that follow, Land Reclamation may be divided under three headings:—

(*a*) Reclamation of water-logged land by means of drainage operations.

(*b*) Reclamation of derelict heath and moorland, by means of acts of cultivation.

(*c*) Reclamation or recovery from the sea of areas of foreshore, by means of the construction of embankments.

It is not intended within the compass of this article to deal in more than a superficial manner with the types of reclamation mentioned under (*a*) and (*b*). Moreover, it is not proposed to deal in any way with reclamation of small areas of land by such operations as "warping," as they obviously cannot be regarded as affording any relief to unemployment.

(*a*) **Reclamation of Water-logged Land by Means of Drainage Operations.**—Although there are here and there specific areas, like the Borth Bog in Wales, where the carrying out of extensive drainage operations constitutes the sole means of rendering a hitherto derelict area suitable for cultivation, there is so much land already actually under cultivation that could be rendered more productive by maintaining existing drains in a serviceable condition that it is hardly necessary to consider such special areas as that referred to. This has been amply demonstrated by the reception which has been accorded by Drainage Authorities, as well as by landowners and occupiers, to the Ministry's Drainage programme for the alleviation of unemployment, during the autumn and winter of 1921-22, of which an account was given in this *Journal* for September, 1922. An even more favourable reception has been accorded to a similar programme repeated during the autumn and winter of 1922-23, of which an account will be given in due course. It seems superfluous, therefore, to attempt to draw any radical distinction between derelict land that requires drainage to bring it back into cultivation, and good land that is being increasingly damaged year after year by neglect of the simple drainage operations that constitute some of the elementary rules of ordinary estate management. Suffice it to say that there is probably no more profitable method of keeping land in good heart and of increasing its productiveness than by paying meticulous attention to the maintenance of its drains, arterial and otherwise.

(*b*) **Reclamation of Derelict Heath and Moorland by Acts of Cultivation.**—The Ministry has records of many areas of more or less derelict heath land, which provide, at the best, the roughest pasture. In isolated cases there is even evidence of the land having at some time or other been under the plough. In a few instances during the War, when Agricultural Executive Committees tackled such areas, the results, as, for example, in the case of Wadfast Moor, in Cornwall, were markedly successful. To embark upon these undertakings, however, as a means of alleviating unemployment is quite another matter. As a rule the areas lie at a great distance from the larger towns where unemployment is usually most acute. Moreover, they are sufficiently inaccessible to the neighbouring villages, where unemployment is less acute, to render it necessary either to lorry the unemployed from their homes to the scene of operations, or to construct especially hutted camps, in which case, apart from the additional expense, there are all the difficulties as regards recreation, etc. In many cases, however, there are preliminary difficulties as regards the acquisition of the necessary land, and, even if those are surmounted, there is no guarantee that, once the land has been ploughed, it will not be allowed to revert again to its original state, especially if, as is the case in many of the heath lands, the results of such cultivation prove indifferent on account of an insufficient depth of soil. Moreover, there is the all-important question of equipment. In isolated cases no doubt small patches of heath land can be reclaimed and added to neighbouring farms, but the attempted reclamation of large and remote areas at once opens up the whole question of the equipment, in other words, the provision of buildings both for man and beast, and even the construction of roads or tracks. The capital costs in this respect are prohibitive and, with the other considerations above referred to, combine to render an undertaking of this nature hopelessly uneconomic. Where an area of this kind has been surveyed and presents possibilities as regards cultivation, the only effective way of bringing it back into cultivation is to attack it boldly with steam tackle of some kind. Thus it ceases at once to offer any prospects to those in search of a means of relieving unemployment.

(c) **Reclamation or Recovery from the Sea of Areas of Foreshore.**—Reclamation of foreshore presents an interesting problem, and affords the real reason for this article.

The mere prospect of robbing the sea of areas over which for centuries it has flowed at regular intervals, appeals tremendously both to the man in the street and to the professional engineer. The latter's appetite is whetted by a fascinating problem where there is unlimited scope for sharpening his wits, and in which he realises by instinct that there is the adventure of what must always be a doubtful contest between man and nature. The very prospect of such a contest makes the problem all the more enticing to the expert.

To the man in the street, however, the undertaking merely presents itself as an obvious and simple expedient for getting something for nothing. He sees miles of out-marsh on which samphire—the presence of which is a sure sign that the sea is receding—may or may not be abundant, apparently only covered at intervals by spring tides; and he immediately visualises a long embankment within which thousands of acres of new land are brought under the plough. Practically never does the man in the street realise any of the difficulties, and it is the object of this paper to divulge some of them. This is all the more necessary in view of the prominence that is given from time to time to possible reclamation schemes as a means of alleviating unemployment.

Let us deal with a few of the inherent difficulties straight away without wasting unnecessary words on them. (1) In the first place most areas, where the foreshore is what is termed "ripe" for reclamation, are as remote from the centre of acute unemployment as the heath and moorlands already referred to above. There are consequently all the difficulties attendant on the construction of hutted camps.

(2) The areas are usually in rural districts, and if large numbers of town unemployed are transported into such districts, the immediate result is that the regular farm labourers of the neighbourhood are drawn towards the works in the hope of the higher wages approaching those of the navvy. If, as in the case of the Ministry's drainage schemes, the rate of wage is fixed to accord with the agricultural earnings of the district, it is soon found that difficulties and dissatisfaction arise by virtue

of the fact that many of the unemployed on the work are urban unemployed, who resent being paid a wage lower than that to which they are accustomed when engaged on other classes of relief work, such as roads.

(3) If no preliminary difficulty has arisen as regards the acquisition of the necessary land, there is invariably the problem of equipment of the reclaimed area with roads and buildings, as well as the burning question of maintenance when the work has been completed. This difficulty is probably the least appreciated by the well meaning, but misguided enthusiasts, who spend their time urging the Ministry, not infrequently through their local Member of Parliament, to embark upon the wildest schemes of reclamation, and in areas where difficulties, obscure to the layman, readily present themselves to the engineer, whose business it is to advise. And yet the task of maintenance is in many cases the greatest objection to work of this kind ever being begun. It is the cost of maintenance that is absolutely crippling the agricultural land in certain parts of the country, and is creating the intolerable position revealed by the instances hereafter described.

Around Rye and Winchelsea, in Sussex, there is a valuable area of marsh land where, sooner or later, the position as regards sea encroachment, or flooding from inland waters will become critical. Rye and Winchelsea lie about two miles apart on two hills which rise out of a flat area of marsh which has at some time or other been gradually recovered from the sea by natural processes assisted by the hand of man. They were originally, as is well known, two of the Cinque ports, and were practically on the sea about 250 years ago. They are now separated from the sea by a frontage of marsh extending anything up to two miles deep. The sea front is some 5 or 6 miles wide, and is bounded on the western extremity by the cliffs in the vicinity of Hastings, and on the eastern extremity by Dungeness. Across this front there is a perpetual littoral drift of shingle from west to east, except near the easterly extremity at Cliff End, where the flood tide, after being checked by the Hastings cliffs, surges on to the low beach, and perpetually threatens to burst through over the marsh land immediately inside the shingle beach. A serious break through at this point would involve the flooding of some 14,000 acres of valuable marsh, which is now used for fattening off sheep. The only method of guarding against such an eventuality and of preserving the foreshore is by the construction of groynes, which cost anything up to £800 apiece, and their constant maintenance. It will be readily realised that extensive works of this kind involve the levying of a rate per acre which is absolutely crippling to the owners of the marsh. Although the Ministry has, by means of grants from its Unemployment Fund, enabled a great deal of useful work to be done at a comparatively small cost to the owners, as only one-fourth has to be refunded, nevertheless this comparatively small contribution will involve a special levy of £2 an acre on certain of the marsh land which the works are designed to protect.

Further east, other areas of marsh land are threatened in another manner. The River Rother, after skirting the hill, upon which the town of Rye stands, proceeds in a straight south-easterly direction towards the sea, passing on its way the little hamlet of Rye Harbour. For many years the outfall channel of the River Rother into the sea has presented very serious difficulties, owing to the littoral drift of shingle above referred to, which has tended to block the river mouth. An elaborate scheme for the construction of training works to maintain the outfall channel was drawn up by the late Sir John Coode. His scheme involved a short training wall on the eastern side, and a longer one on the western side, one effect of the latter of which would have been either to arrest or divert into deep water the shingle drifting from the west. The authorities proceeded to construct the shorter or eastern wall first, and then, finding their funds exhausted, left the western wall, or in other words the more important one, unconstructed. The result has been that the drift of shingle into the channel has continued uninterrupted, and in the last two years, has piled up across the mouth of the river an effective barrier, which has completely changed the course of the outfall, and made the harbour almost completely impracticable for ships of any kind.

From a recent inspection, it would appear probable that the accumulated shingle will continue to accrete towards Dungeness, and make it increasingly difficult for the river to find any outlet at all. In that event a vast freshwater lake would be formed all over the marsh lands on which stands the small hamlet of Rye Harbour, lying between Rye itself and the sea.

The particulars of this case are given in detail, because they offer a striking example of land which has been recovered from the sea with valuable results extending over many years, but which is now likely to return to something worse than its former state, because the cost of stabilising the sea defences has proved out of all proportion to the value of the agricultural lands which can be assessed for the purpose.

To take another example. Shortly after the termination of hostilities, the Ministry itself embarked upon a scheme of reclamation in the Wash, where there are undoubtedly large tracts of foreshore "ripe" for reclamation. The area originally intended to be reclaimed was some 1,500 acres, but owing to the need for national economy, the original programme was finally curtailed, so that only about 300 acres were ultimately enclosed and these were the less valuable portion of the original area. Taking everything into account the cost worked out at something like £160 per acre. The area enclosed, although offering valuable pasture, can only be turned into arable land in its entirety, when the channels of the old sea creeks, which still remain in the enclosed area, have either been filled in or have flattened out as the result of many years of ploughing. The bank has stood well, but will require careful attention for some years to come, especially at one particular point where the North Sea, under certain conditions of wind and tide, strikes it with its full force. Until, therefore, the out-marsh in front of this particular section of bank has been able to collect a sufficient "apron" of silt outside the toe of the bank to break up wave action, this particular section of bank will always require a certain amount of money to be spent on it, to guard against the possibility of it being breached by an occasional heavy sea.

The heavy burden involved by maintenance, does not, however, only arise in connection with land which has been recovered from the sea naturally or reclaimed by specially constructed embankments. On many parts of the coast the sea is actively encroaching, and although the Royal Commission on Coast Erosion, which reported in 1911, found that on the balance there was more land being automatically reclaimed from the sea than was being encroached upon by the sea, the menace of sea encroachment remains a serious one, because of the heavy burden involved on the agricultural land affected by virtue of the rates levied on it to provide moneys for its protection.

The Lincolnshire coast from a little north of Skegness, right up as far as Mablethorpe, represents an area where there is a perpetual contest going on between man and Nature. If once the sea were allowed to effect a serious break through on a wide front, thousands of acres would be permanently submerged. Rail communication would probably be interrupted, and untold suffering caused in hundreds of homesteads. Already the sea has made severe inroads. Far outside the existing sand dunes on the sea-shore, will be found tile drains, of a kind for which exhibition prizes were awarded nearly 100 years ago, and which are still *in situ* in the original lines along which they were laid when the land was corn-growing land, even within the memory of some of the oldest inhabitants of these parts. The sea has now, however, reached the final line of sand dunes which are of varying thickness. In several places they are so inadequate, that spring tides occasionally breach or overtop them into the rough pasture land beyond. Throughout only a short length of this coast there is in the rear a bank constructed by the Romans as part of that which extends all round the Wash.

During the past two years the Ministry of Agriculture by means of its Unemployment Relief Grant has been able to save the situation by advancing sums of money which could never have been found by the Commission of Sewers responsible for maintenance; but, sooner or later, the works which have recently been constructed will require renewal, and the position will again become critical. Since it is a fact that some of the areas on this coast are rated at £1 per acre to pay for a bank which has been subsequently breached, and that complete protection, say, for 30 years might involve an expenditure in the neighbourhood of a quarter of a million sterling, it will be realised why so much weight is attached to the item *maintenance*.

During the last three or four months, pressure has been brought to bear upon the Ministry to reclaim a large area of foreshore lying in the estuary of the Humber. The scheme was typical of those submitted by enthusiasts who have no appreciation of the difficulties. In the first instance a soil survey was carried out by two experts who reported that, of the 10,000 acres claimed to be reclaimable, only about 250 acres were of sufficient value for the purpose. A subsequent survey by the Ministry's engineers showed that even if it were possible to enclose a larger area by means of an embankment, such an embankment would have to be constructed by means of hopper or other barges operating from the sea-ward side, as it is entirely impossible to carry out operations on the mud area proposed to be reclaimed. This consideration alone at once ruled out the scheme as one likely to offer relief to the unemployed. There were also legal difficulties which need not be enlarged upon here.

Only recently a speech was delivered in the House of Commons, urging the Government to undertake land reclamation. Reference was made to modern machinery, which was stated to have done valuable work in Canada. If modern machinery could be used for this purpose, it would be of no use to advance land reclamation as an unemployment scheme; but those who advance the cause of modern machinery appear to overlook the fact that no modern machinery has yet been devised which would work effectively on an out-marsh, which is, at varying intervals, liable to inundation by the tide. Possibly some form of machine with caterpillar appliances and all working parts enclosed might be devised to meet the situation, but the matter has not been attacked from that point of view, seeing that hitherto the advocates of land reclamation have only advanced it in the interests of unemployment relief.

As already intimated the above instances have been given somewhat in detail in order to bring into prominence the heavy cost of maintenance, as the importance of this item with each new reclamation scheme tends to recede further and further into the background.

The cost of maintaining sea defence works on a stretch of coast where the conflict between man and Nature is constant may be taken to work out at something like £300 to £500 per annum per mile. Assuming the average depth of the agricultural land requiring protection to be a quarter of a mile—in many places it is of course considerably more—the cost of maintenance would be nearly £3 per acre in perpetuity. As the average rental value of this land could hardly exceed 50s. an acre, it will be seen that the position is utterly uneconomic.

Again, in the case of an area of land which has been artificially reclaimed by means of an embankment, quite apart from the initial cost of the work of actual reclamation, the reclaimed land is immediately saddled with a maintenance cost of something like £300-£400 per mile for at all events a period of, say, 10 years. As the reclaimed land must usually be allowed to settle down for some years before its full value is attained, it is obvious that here again the cost of maintenance is out of all proportion to the rental value of the land at any rate for a considerable number of years.

That this factor is beginning to be appreciated in various parts of the country is evident from the appeal that is being made to the Government from all quarters to make the cost of sea defence works a national charge. This was carefully considered by the Royal Commission on Coast Erosion in 1911, who, appreciating the difficulty of reconciling the value of agricultural land on the coast with the enormous cost of maintaining sea defence works for its protection, saw no good reason for transferring to the State the cost of those maintenance works. It does not appear that any such radical changes have taken place during the last 12 years as would justify a modification of the views held by the Royal Commission.

In conclusion, I cannot close the above remarks without a word of thanks, for his advice and assistance, to Mr. C. H. J. Clayton, M.Inst.C.E., the Ministry's Chief Drainage Engineer. It is his enthusiasm for everything connected with land drainage that affords the inspiration for my remarks. His recent retirement from the Ministry after 41 years of loyal and distinguished service will create a gap which it will be difficult to fill, but it is satisfactory to know that, in spite of his retirement from the service of the Crown, his services will not be lost to the cause of land drainage generally.

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A TRIAL OF HARVESTING MACHINERY:

BINDERS, AND A BINDING AND STOOKING MACHINE.

THE self binder seems a natural development of the reaping machine, but it was only in the latter part of the 19th century that it was produced in approximately its present form. The advantages of mechincal methods of harvesting were appreciated in classical times, and Pliny makes reference to machines in use on large estates in Gaul during the first century. These consisted of big shallow baskets with forward projecting teeth, pushed through the crop by horses harnessed at the rear. The fall of classical civilisation, however, meant for many centuries the neglect of mechanical contrivances, particularly in agriculture, and it was not until about 1870 that the invention of the Appleby Knotter resulted in the construction of a complete binder that in its general principles did not differ greatly from the machines in use to-day. By the invention of a machine for stooking the sheaves delivered by the binder, a further stage has been reached, and it is now possible to cut and stook cereal crops by means of machinery.

In order to obtain information for the guidance of farmers as to the comparative cost and utility of cutting and stooking corn by various methods the Ministry arranged for a test to be carried out with the following machines:—

a. Massey Harris Binder drawn by 3 horses.
b. McCormick Binder „ „ tractor.
c. Two McCormick Binders „ „ tractor.
d. McCormick Binder and Stooker drawn by tractor.

The tests took place in the vicinity of St. Albans, namely, at "Oaklands." the Hertfordshire County Farm Institute, through the courtesy of the Hertfordshire Agricultural Education Committee, and at Cunningham Hall Farm, through the courtesy of the occupier, Mr. R. Baum.

Good crops of both oats and wheat were obtained at "Oaklands," but at Cunningham Hall Farm the crops were not so good, and in parts had been badly laid by the previous bad weather. On both farms the soil was medium loam containing a large number of stones, while in parts rain had caused the ground to be soft. At the Institute Farm, a steep gradient at one end of the field added to the severity of the tests, but all the other fields were level.

Before records were taken, each machine was permitted a preliminary cut on its particular plot. Records were taken of:—

1. Number of men employed in cutting.
2. Number of men employed in stooking.
3. Consumption of fuel and lubricants.
4. 'Acreage cut in the total working time.
5. Stoppages—time lost and cause.
6. Weight of crop cut.

Observations were made of the quality of work done, and any other factor affecting the economic or mechanical efficiency of the machine.

Agriculturists are, as a rule, familiar with the design of binders, and detailed descriptions of the machines have been omitted. The differences in the construction of the various types of binders on the market are not very pronounced. Such differences as do occur relate principally to minor details, such as the construction of the knotter.

(*a*) **The Massey Harris No. 5 Horse Binder**—Manufactured by Messrs. Massey Harris, Ltd., 53/5, Bunhill Row, London, E.C. Price £58.

	Oats.	*Wheat.*
Acreage cut per hour	1·33 ...	·85
Cost of cutting per acre	4s. 8d. ...	6s. 0d.
„ „ stooking „	1s. 8d. ...	1s. 11d.

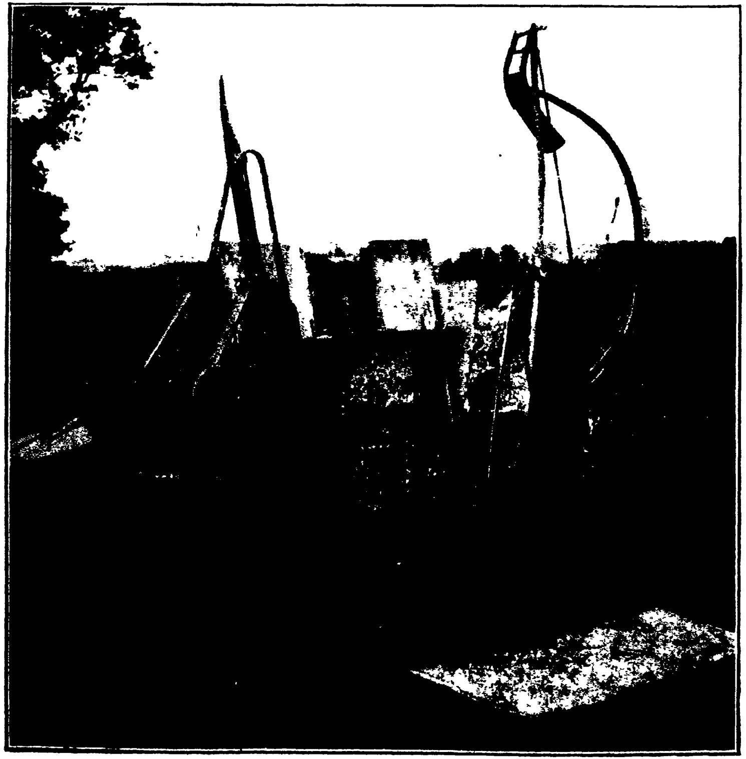

FIG. 1.—International Stooking Machine.

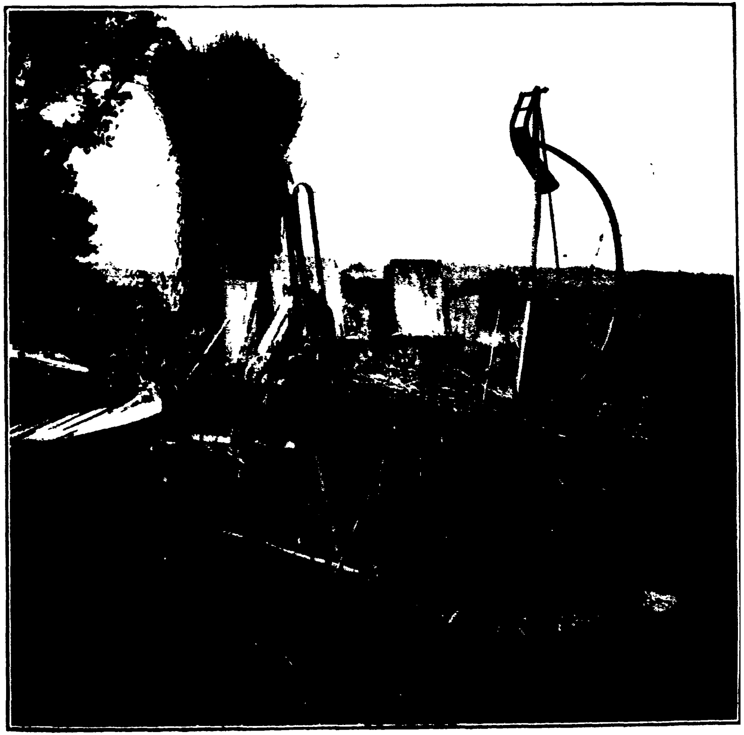

FIG. 2.—Stooking Machine, showing Stook being formed.

FIG. 3.—Binder with Stooking Machine, from which a Stook has just been dropped.

FIG. 4.—Two Tractor-drawn Binders with Steering Apparatus.

The Massey Harris Binder used in these trials had been in use for 12 years, but was in excellent condition. The machine was drawn by three horses and operated by one man. Four men were employed for stooking. The horses were replaced at midday by a fresh team.

The crops of oats and wheat were generally thin, but a considerable amount of undergrowth caused frequent choking of the canvases. The oats were cut at an average speed of 1·95 m.p.h. and the wheat at 1·41 m.p.h.

The work done by this binder was satisfactory in every way, and in spite of the soft surface in parts, the horses easily hauled the machine.

(*b*) **One McCormick Binder**—Supplied by the International Harvester Co. (Great Britain), Ltd., 80, Finsbury Pavement, London. Price £58. Fordson tractor, £120. Nelson Simplicity Binder Hitch, £5 10s. Agents, Messrs. A. Dugdale, Ltd., 65, Conduit Street, London, W.1.

	Oats.		*Wheat.*
Acreage cut per hour	1·51	...	1·25
Cost of cutting per acre	5s. 1d.	...	5s. 11d.
„ „ stooking „	1s. 4d.	...	2s. 0d.

The only difference between horse drawn and tractor drawn binders lies in the form of hitch used.

The Nelson Simplicity Binder hitch (see Fig. 5) consists of two parts, the first of which is attached rigidly to the tractor drawbar, and the second to the binder stub pole. The second part is swivelled to the first and when working on the straight, occupies a position inclining at roughly 45° to it. The hitch therefore brings the binder more to the left and so permits a full cut to be made, and in addition greatly facilitates cutting at corners.

The field of oats upon which the machine was first employed had a steep gradient at one end. Owing to the great number of stones on the ground, close cutting was not attempted. The canvases were choked on three occasions owing to the quantity of undergrowth.

A part of the field of wheat was not standing well, and it was necessary to miss cutting one end on each round. Time lost for this cause has been deducted from the total working time. The Fordson tractor was not able to work so fast on wheat as on oats, the speed being 1·98 m.p.h. as against 2·66 m.p.h.

(*c*) **Two McCormick Binders** supplied by the International Harvester Co. (Great Britain), Ltd. Coupled by "International" hitch and drawn by International Junior and Saunderson Tractor. Price of Binders £58 each, Hitch £8 15s., International Tractor £250.

	Oats.		*Wheat.*
Acreage cut per hour	2·72	...	2·37
Cost of cutting per acre... ...	4s. 4d.	...	4s. 9d.
„ „ stooking „	1s. 3d.	...	1s. 10d.

Two McCormick binders were coupled together by means of a special steering hitch manufactured by the International Harvester Co., and were drawn by an International Junior tractor on wheat, and by a Saunderson on oats.

The hitch is so constructed that the relative position of the second machine to the first may be accurately adjusted by means of a conveniently-placed steering wheel on the rear machine. By this means the second binder is enabled to cut a full swath on the straight and to negotiate corners. There-was a certain amount of difficulty however in steering both machines round corners.

The oat crop was fair, but occasional patches of undergrowth choked the canvases. The time lost through stoppages, however, was not large.

The wheat was only a moderate crop and was so badly laid in places that good cutting was impossible. On this plot the two binders were drawn by an International Junior tractor.

On both fields, the great capacity of the machines was a very noticeable feature. The sheaves discharged from the binders usually dropped in pairs, one from each machine, and this greatly facilitated the labour of stooking.

(d) **The McCormick Binder and Stooker.**—Supplied by the International Harvester Co. (Great Britain), Ltd. Price of Binder, £58. Price of Stooker, £50. International Junior Tractor, £250.

	Oats.		*Wheat.*
Acreage cut per hour	1·52	...	1·14
Cost of cutting and stooking per acre ...	6s. 1d.	...	7s. 6d.

The stooking machine is a device of special interest and calls for a detailed description. It is attached to the rear of the binder and stooks the sheaves while the binder is travelling. The power for performing the various operations, is obtained by means of a shaft, driven from the crank shaft of the binder. The sheaves are delivered on to the fork in pairs. The first sheaf is held on the binder platform until the arrival of the second, when a "kicker device" delivers them simultaneously. In so doing, a trip lever is actuated which causes the fork carrying the sheaves to describe a semi-circular movement, thus delivering the sheaves into the stook setter with their butts to the rear. During these trials the experiment was made of inserting a V-shaped dividing tine into the stook setter for the purpose of opening and spreading the base of the stook. The number of sheaves contained in the stook may be determined by previous regulations, but the stook may also be tripped at will by the operator irrespective of the number of sheaves it contains. Upon the requisite number being placed in the stook setter, a compressor arm, which also forms the needle, is set in motion, causing it to compress the stook and tie it. The knotter is similar to that in use on the McCormick binder. The stook setter is wider at the rear than at the front, to assist in making stooks that will stand well when discharged. It is provided with an inclined bottom which is pivoted, permitting it to tilt to the rear and discharge the stook after being tied. The stooks are discharged with a quick movement, and as they leave the stook setter, tines spread the butts in order to give the stooks a substantial base. Facilities are provided for raising or lowering the stook setter, as necessitated by the height of the crop.

An International Junior tractor was used throughout to draw the machines. The weight of the stooker is considerable and the draught is increased disproportionately owing to its method of attachment, but the tractor at no time showed signs of being overworked.

One man only is required to operate the binder and stooker. The stooker was readily attached to the binder and worked with very little attention, while the proportion of time lost was comparatively low.

The oat crop was not a very good one, and the stooks made by the machine generally had the tops too large and insufficient air space were made.

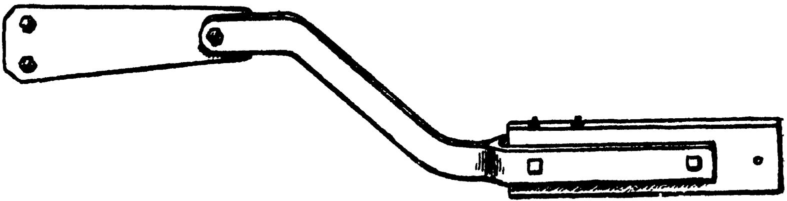

FIG. 5.—The Nelson Simplicity Binder Hitch.

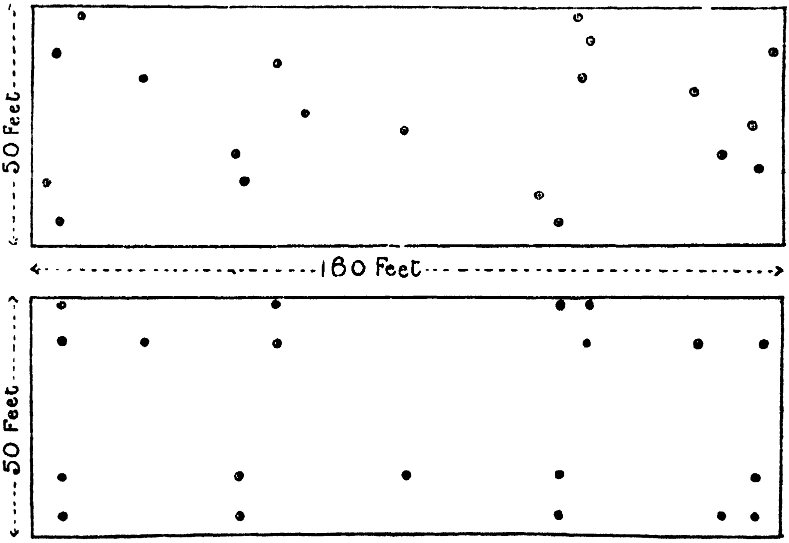

FIG. 6.—Showing Positions of Stooks.
Top, as left by Stooking Machine ;
Bottom, as left by Hand Labour.

The stooker was first used on wheat at Oaklands, but owing to there being an insufficient acreage, it was afterwards transferred to Cunningham Hall Farm. At Oaklands there was an excellent crop with long straw, and upon this the stooking machine did very good work, leaving the stooks with small conical tops and adequate air spaces. After being transferred to the other farm the machine was not able to do such good work, chiefly owing to the poorer crop. The air spaces left were considerably increased later by the introduction of a V-shaped tine inserted in the cradle, which divided the sheaves as they were delivered by the fork.

The number of sheaves in each stook is determined by previous regulation by the operator. It was observed that one or two of the stooks in each field were not tied properly, and in addition about one in twenty did not stand properly after being tripped. These are minor faults which may readily be overcome. In the latter case the wider spreading of the butts would increase stability and provide for greater aeration.

The irregular disposition of the stooks as illustrated in the accompanying diagrams (Fig. 6), is a disadvantage as it materially increases the labour of carting.

Attention is given later in the Report to general economic factors governing the use of a stooking machine.

(To be concluded.)

* * * * * *

DEVON LONGWOOL SHEEP.

EDWIN LAWRENCE,

President of the Devon Longwool Society.

ANCIENT writers state that the foundation of the Devon Longwool Breed is of great antiquity, and from time immemorial it has been extensively kept in the vales and on the hills of the most Western Counties of England. It is indigenous to the West, and has proved its adaptability therein, but no one has yet been able to trace its origin. In Youatts' "Complete Grazier," these sheep are described as the Devonshire polled sheep, or Devonshire Nott, crossed with the Leicester, producing a sheep with a white face and legs, known as the Bampton Breed, giving a heavy carcass with a long fine wool. Another writer claims a parish in Somerset to be the place of development of this cross of Leicester with the old Devon Nott; he adds that it is the best breed living.

That this breed of sheep in the past attained great weight is confirmed by a record of a Mr. George Turner, of Thorverton, Devon, who had forty two-year-old wethers whose carcasses were estimated at 40 lb. per quarter. In 1858 a Mr. John Bird, of Volis, near Taunton, sold four-fifths of his shearling wethers at fifteen months old at 28 lb. per quarter dead weight. Both these lots had been fed without any cake or corn. Spooner's history of sheep stated that a wether of this breed slaughtered in 1835 weighed 70 lb. per quarter. Mr. J. J. Walker wrote to the *Meat Trades Journal* in 1846, giving particulars of two sheep, bred and fed by Mr. T. Kingdon, of Thorverton, Devon, which when slaughtered weighed, the wether 78 lb. per quarter, and the ewe 57 lb. per quarter, being the heaviest sheep ever killed in Her Majesty's Dominions.

The *Farmer and Stockbreeder* in 1899 published the report of an independent writer who said "this breed should claim a fair share in the export trade. Amongst its many qualities are size, strength of constitution, heavy fleece of excellent wool, width and depth of carcase, of superior flesh, great hardiness, and aptitude to lay on flesh and not fat."

This breed of sheep for many years before the War well proved its suitability for export. For the purpose of founding flocks abroad ewes and rams have been exported, also rams for crossing with merino and other breeds, resulting in heavy fleeces of silky wool, and early maturity mutton, showing rapid growth and production of a fine class of meat. The writer amply proved this by Smithfield results, when Devon Longwools competing against all Longwools (Lincolns excepted), four years in succession (1911-14, the only years competing) gained first prize and the breed cup. Some of these sheep attained the dead weight of 40 lb. per quarter, at nine and a half months of age. The progeny of Devon Longwool ewes crossed with a Hampshire Down ram, won first prize three years in succession (1911-13) at the Smithfield Club Show, in competition with entries numbering fifteen to twenty representing various Longwool and Shortwool crosses; these crossed lambs reached a carcass weight of 120 lb. per sheep at nine and a half months old.

Export trade before the War was successfully carried on by various breeders, members of the Society. One noted breeder exported several consignments of rams and ewes to South America, the Government of Uruguay, New South Wales, Australia, Buenos Ayres, and Montevideo. Other breeders have exported sheep to South America and Australia.

Devon Longwool flocks are principally kept in North and East Devon, West Somerset and Cornwall, while flocks are established in other counties. The popularity of the breed is accounted for by the qualities already mentioned, viz.:—great depth of flesh; for early forcing a suitable weight carcass is easily obtained; and the long silky fleece is of great weight, before the War commanding a remunerative price often equal to cross-bred wool.

Owing to the collapse of Russia, formerly a prominent buyer of English long wools and heavy woollen goods, and the fact that the Government held heavy stocks of wool, longwool has for some time met a low dull trade, but recently the prices have advanced considerably. There is every reason to look for further rises, and no doubt this class of wool will soon reach a more profitable price. When everything is considered, this breed doubtless shows equal profit to any other breed from wool value, as the weight clipped on an average would be double or more the weight of any Shortwool breed, ordinary flocks yielding 12 lb. per sheep and 4 lb. per lamb. Some breeders have recorded heavier weights than those quoted. The writer once clipped three rams, two fleeces weighing 29½ lb. each, and the other 30 lb.

The breed has been greatly popularised and rendered additionally useful by the efforts of the Devon Longwool Sheep Society, which was formed many years ago. While not being a large organisation, it is very successfully conducted on practical lines, the members being farmers and successful breeders largely of the tenant-farmer type. As most of the breeders reside in the West of England, the distance from the large shows and the consequent heavy expenses incurred by showing, account very largely for the fact that the breed has not been so largely represented as it ought to have been at the Royal and other prominent shows.

Flock reports show that the ewes are excellent mothers and heavy milkers, very hardy at lambing time, and eagerly sought after by those who do not keep standing flocks, for running on grass or feeding partly on turnips as is the custom in the south-west. They answer admirably when crossed with a Shortwool ram, for fattening lambs, which come forward very rapidly. For early maturity they will easily attain a marketable size and weight—60-70 lb. at six to eight months old.

These sheep at all ages will do equally well on grass or with a portion of soiling crops, and for constant winter feeding off roots on arable land cannot be beaten.

The Ram for Crossing Purposes.—Rams of this breed coming from the hills of Devon and the Western Counties are hardy and unusually active, and will cover from sixty to eighty ewes. They have been successfully crossed with the Merino abroad,

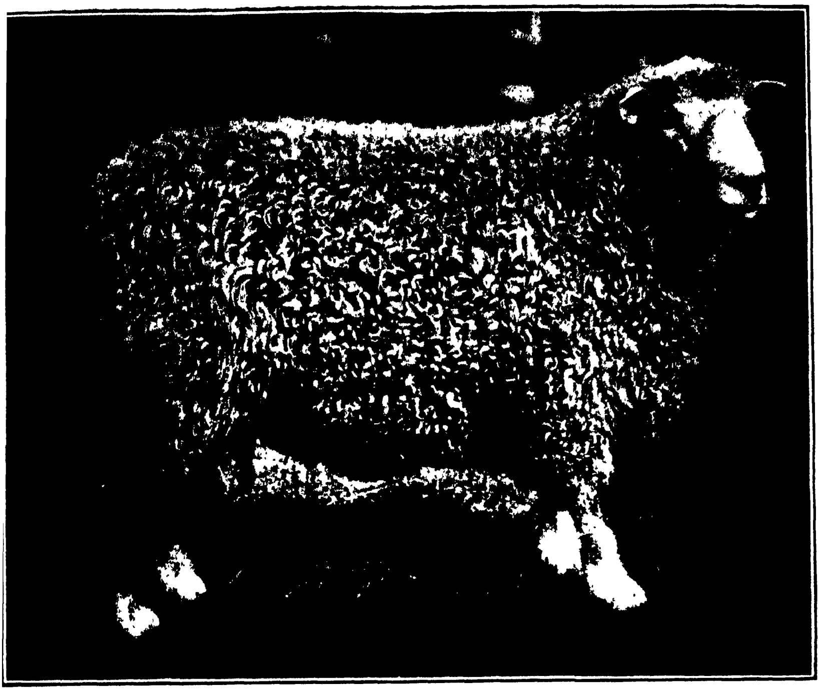

FIG. 1.—Typical specimen of a Devon Longwool Ram.

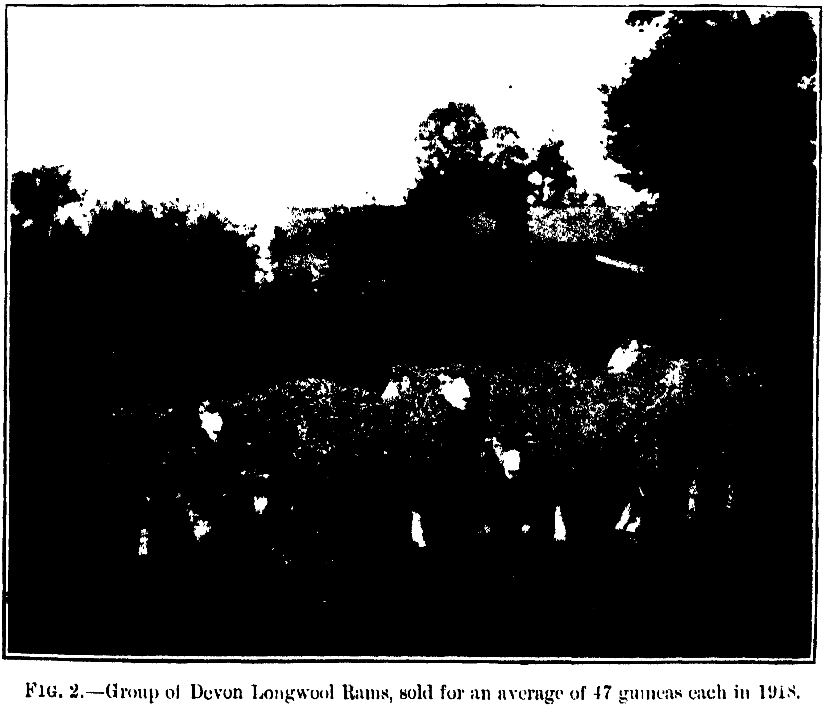

FIG. 2.—Group of Devon Longwool Rams, sold for an average of 47 guineas each in 1918.

and with Shortwooled ewes at home, where they increase the size of carcass and the weight of wool.

Owing to their early maturity they are excellent for the production of early fat lambs, and are also equally satisfactory for summer grazing or finishing off on arable land during the winter. The principal ram sales are held at Taunton, Tiverton, Exeter, and Barnstaple, during the months of July and August.

Points to notice in selection may be summed up as follows:—

Rams.—Activity, with a bright eye, denotes promise and suitability for service.

Head should be of fair length with a broad face and nose, points of nostrils black in colour, the face of a clear colour, free from black or blueness; with a broad poll well covered with good wool, free from hair and coarseness.

Ears, of fair length, not thick or heavy, clear in colour, showing a few prominent black spots of pea-size (the saying of old breeders being that every spot is worth a guinea). There should be an absence of wool on the ears.

Neck should be massive, rising from the body, not long but well set up, giving a bold appearance.

Fleece, an important feature, should have a strong curl all over the body, of a long free silky wool with no mixture of hair, extending at the hindquarters down to the feet, thereby producing quality and quantity of high-grade wool.

Skin should be white and clear, free from black spots or blueness.

Back, level and straight, with a firm back and loin of flesh and minimum of fat, having a thick tail and plump legs of mutton. The animals should stand on short legs with fair-sized bone and feet, these features denoting thick flesh and strong constitution. If these points are secured the results will be all that can be desired for quality, early maturity and profit.

Females.—Similar remarks will apply with some exceptions, viz., if the farmer's aim is to fatten lambs only, he should select ewes and rams showing most readiness to put on fat quickly, producing a back with a fat touch (as is looked for by the buyer of fat lambs) thereby sacrificing somewhat growth and weight of carcass, also wool weight which is not valued in a killing lamb.

The Secretary of the Devon Longwool Society is Mr. A. Gerrard, Wiveliscombe, Somerset, who is always pleased to give information concerning the breed, and to enrol new members.

SEED MIXTURES FOR GRASSLAND.

PROFESSOR R. G. STAPLEDON, M.A.,
Welsh Plant Breeding Station, Aberystwyth.

IT is never easy to decide on a seed mixture to suit particular soils and circumstances. To-day, when every penny must be saved, money must only be spent on those species and varieties which (if, of course, the "take" be satisfactory) may be depended upon to succeed.

Need of Experiments.—It is a difficult matter, even after close inspection of a field, to prescribe the *right* mixture for it. It is at best only possible to prescribe a "sensible" mixture which may be hoped to give good results; the farmer himself, after making a few simple trials, could probably do better.

In the first place the farmer should always draw up his own mixture or at all events know precisely what and how much of each kind of seed he has sown. In the second place, on some small corner of every field seeded out he should sow some entirely different mixture to the one he has relied upon. Perhaps he has not included wild white clover in the general mixture—it should be sown on the special corner. Perhaps he has included 20 lb. of perennial rye grass and only, say, 2 lb. of cocksfoot—he might sow at the rate of 8 lb. of each in his corner. He may have used 10 lb. of red clover in his mixture—let him try 4 lb. in his corner. This would involve very little trouble, but in a very few years would put the farmer in the position of being his own expert on seeds mixtures for his farm.

Importance of Strain.—It is not enough merely to choose the species to be sown; often, as for instance with white clover, red clover and cocksfoot, the proper strain or nationality must also be selected.

With *White Clover* this is especially important. Wild white clover is at present much more expensive than commercial white Dutch, but commercial Dutch should only be used in leys sown down for at the most two years for sheep grazing. In this case it would be sown in large amount probably with rye grasses only. Yet even for short duration leys wild white is valuable, because in conjunction with perennial rye grass and rough-stalked meadow grass it tends rapidly to form a dense sward and to suppress weeds and bent grasses. For longer leys and for permanent grass it is of course invaluable; it is probably the one seed of commerce capable of producing really perennial and persistent plants.

With *Red Clover* too nationality and strain are very important. There are only two main types of red clover—early and late. The early are commercially known as broad red clovers—sometimes also called cowgrass or giant hybrid cowgrass. The late are late-flowering reds or single-cut cowgrass, sometimes also supplied under the names of cowgrass or giant hybrid cowgrass. Unfortunately the seed of the two types cannot be distinguished. The early reds flower earlier in the spring and tend to produce rather more in the autumn of the seeding year than the general run of the lates. They aftermath abundantly, but are not usually long persisting. The lates flower 10-14 days later than the earlies, have not time to produce a heavy aftermath, persist longer, and some of them, even in the first year, produce heavier hay crops than the earlies. Some, too, are extra late flowering and extra persisting, as for instance the strains grown in Montgomery and in the Wadebridge district of Cornwall. For leys of two years and upwards the lates should be mainly relied on. Unfortunately few of the foreign nationalities of red clover consist wholly or even mainly of late-flowering types. Home-grown seed, so far as the north and west of England are concerned, does, on the whole, better on long duration leys than foreign seed.

Of *Cocksfoot*, New Zealand seed,* in trials both at Cockle Park and at Aberystwyth, has proved decidedly superior to Danish and American, particularly for long duration leys. French seed, as was shown some time ago in Denmark and more recently in Wales, is inferior for the longer leys

Complex *versus* **Simple Mixtures.**—Complex mixtures (mixtures of a large number of species) are still popular for the longer leys and permanent grass, and until comparatively recently were almost wholly relied upon for these purposes. Recent work in Sweden has shown—and in this country it is coming to be realised—that the complex mixture is likely at best to be wasteful of seed and will frequently not give as good results as a relatively simple mixture. In America, too, the mixtures now generally employed for establishing long duration swards seldom contain more than about six species. The observations of Osvald* on this subject, although based on researches conducted in Sweden, are of particular interest and are undoubtedly equally applicable both to the conditions and to the practices prevailing in this country. He points out that for a considerable time pasture trials were conducted on the principle that the artificially produced swards should be made to approximate as nearly as possible to the natural grasslands. A consequence of the application of this principle has been the inclusion of a large number of species in the seeds mixture—an erroneous idea which in his view has been based on an imperfect knowledge of the composition and ecology of grasslands. More recently, the object aimed at has been to combine, in the species included, high yield, winter hardiness and permanency, and to adopt treatments calculated to create the best conditions for the development of a good sward.

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* There is not much New Zealand Cocksfoot on the market, but if its merit were more fully recognised by farmers, larger supplies would no doubt be forthcoming.

In the opinion of the writer there are three distinct and final objections to the complex mixture :—

(1) There is too much competition between the different species.

(2) Some of the included species are almost certain to be unsuitable to the particular conditions.

(3) The seeds of different species require very different conditions, if they are to germinate and thrive.

Competition.—Some species make very rapid growth during the seeding year; others start slowly and, during the first autumn after sowing, produce practically no keep. The quick-growers naturally tend to crowd out the slow, especially when the slow are "top" species, requiring light to grow properly. Italian rye grass, unless sown in very small amount, crowds out other plants badly, and so also to some extent do the early red clovers. The former is sometimes included in long duration mixtures to keep down weeds (work which should be done by wild white clover) but it will quite effectively suppress meadow fescue, meadow foxtail and some other grasses, and considerably interfere with cocksfoot and Timothy. Perennial rye grass if sown too thickly (20 lb. or in some cases less) will interfere with cocksfoot and Timothy (especially when these are sown thinly), while if sown in less amount (14-16 lb.) it will hamper meadow fescue and meadow foxtail.†

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* Osvald, H., Några nyare synpunkter vid uppgörande af gräsfröblandningar för slåtter-och betesvallar på torfjord. *Svenska Mosskulturföreningens Tidskrift*, 1920.

† Generally speaking both the rye grasses germinate considerably better than all other grasses, except perhaps Timothy. This better germination must be taken into account, as well as the rate of seeding, when considering their tendency to hamper other plants.

Thus we should include in a mixture only such species as agree well together. For hay, species and strains must be chosen which will flower about the same time; this is impossible if numerous species are included. With late-flowering red clover we should choose a late strain of cocksfoot (this is a point in favour of New Zealand cocksfoot). With Timothy predominating, one of the latest late-flowering red clovers, such as an approved Montgomery Red, is to be preferred.

Unsuitability to particular Conditions.—If plants unsuitable to their surroundings are sown in competition with many better adapted species their chances are naturally poor, and the smaller their share in the seeding the less their chance will be. Thus, to sow ½ lb. or even 1 lb. of Chewings fescue, of rough-stalked meadow grass (on some soils), of smooth-stalked meadow grass (on other soils), of golden oat grass and meadow foxtail, is often sheer waste.

Many species are so unsuited to particular conditions that even when sown on almost even terms with better adapted competitors, they will not succeed. Chewings fescue, for instance, may compete on some types of soil, on most it cannot. Again meadow fescue will only succeed in competition on very fertile soils, and much seed of this grass is probably sown in vain.

Different Conditions for Germination of Different Species.—The question of depth of sowing and method of covering seeds is important.* The question of temperature is perhaps equally important.

Seeds mixtures are generally sown in late March or in April according to district. At that time the temperature is generally ideal for the rye grasses and the clovers, species which usually make a better early growth than most of the others in a mixture. The temperature even in April, however, is often not so favourable for cocksfoot nor well suited to grasses like Chewings fescue and the meadow grasses, while for meadow foxtail it is often fatal.

Thus for April sowing, cocksfoot, if sown in competition with rye grass, must be sown in large amount; the meadow grasses and Chewings fescue if included at all, should not be stinted.

It will thus be gathered that a "sensible" mixture is one which contains only those species which, at the date of sowing, and in the competition which they are likely to encounter, have the best chance. There will scarcely be a large number of such species. Consequently a " sensible " mixture is generally one consisting of a very few species each sown in either considerable or moderate amount.

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* See Williams, R. D., "Depth of Sowing Grass and Clover Seed," this *Journal*, April, 1922; May, 1922; and March, 1923.

How to decide upon a Grass Mixture.—It might be thought that an examination of the species composing any good permanent grass on the farm would be enough to show the farmer what he should include in a new seeds mixture. This is only very partially true. He finds, let us say, rye grasses or meadow fescue and fine leaved fescues, or meadow foxtail thriving exceedingly—but can he now purchase *the self-same strains* of these? And if he can, will they, in the face of the difficulties described above, be sure to succeed? Fields or plots, sown down with a *known mixture*, examined three or four years after sowing, are a much better guide.

Permanent fields, however, will give some guidance, especially for long duration leys or permanent pasture. If the examination showed the presence of meadow fescue, it would probably be wise to sow this bountifully and to reduce the rye grass considerably, so as to give the fescue a good start. Suppose wild red clover is abundant. It would then probably pay to take pains to secure a reliable strain of the long-persisting Montgomery type. If wild white clover is not much in evidence on the older fields, then it should be included in the new mixtures. If perennial rye grass is practically absent, it would be sound to include about 2 lb. of crested dog's tail* in the new mixture, especially if sheep grazing is desired. Nevertheless, for most conditions, a good mixture will be drawn up chiefly by choosing from a *limited* number of " *bed-rock* " species and only including others when either they are supported by strong local evidence or when the mixture and the time and conditions of sowing are all planned chiefly in the interests of one particular species which it is desired to include.† The " bed-rock " species for leys of two years and upwards and for permanent sowing are :—perennial rye grass, cocksfoot, Timothy, rough-stalked meadow grass and crested dog's tail, with the various strains of red, Alsike and wild white clovers.

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* On certain types of soil (especially those on which perennial rye grass does not establish itself permanently) there is no doubt of the value of crested dog's tail. The appearance of the dry flowering stalks is no indication that stock do not graze, or have not grazed, the leafage.

† For instance, the enormous sowings of the grasses such as Chewings fescue and the like on specially prepared tilths for lawns and putting greens.

Manuring.—This question, which cannot be dealt with here, is as important as, if not more important than, the choosing of the mixture. A young ley, however, must have phosphates, of which a sufficient amount, either in the form of basic slag or one of the approved mineral phosphates, should be applied before sowing. On certain soils the addition of potash is almost equally important.

Purchase of Seed.—In the purchase of seed the farmer is protected by the Seeds Act, 1920, and by the Seeds Regulations, 1922. In the case of cocksfoot and of red and white clover (as well as of certain other specified seeds), the seller must state (what is very important for the farmer to know) the country of origin. The farmer can also obtain, for a small fee, a report on seed which he proposes to sow, from the Official Seed Testing Station, Huntingdon Road, Cambridge.*

The farmer should not expect or desire so good a germination from English and particularly from Welsh clovers as from foreign, nor from wild white as from white Dutch clover. Nor should he object to New Zealand cocksfoot, if it be found to contain a considerable quantity of perennial rye grass. Correct strain is of more importance than superlative germination, or, provided injurious weed seeds be not present, than absolute purity. Of course where the germination is low, the seed rate must be adjusted accordingly.

Price of Seed.—In deciding upon a mixture the question of cost is generally uppermost, but obviously there should be no hesitation in paying more for a long than for a short duration mixture. The farmer's rule should be to buy the best (as judged by strain, absence of injurious weed seeds and reasonable germination) of comparatively few species, rather than to spend the same money on inferior seed of many species. For leys of two years and upwards, he must first ask himself how much wild white clover seed is required. On some fields, particularly if plenty of phosphates have been used and liming regularly practised, wild white clover spreads rapidly without sowing. In such cases the farmer may be tempted to leave wild white out of his mixture; but it is generally worth while including even so small a quantity as ½ lb. to assist in suppressing weeds. Having decided the quantity, he must ascertain the cost of reliable seed and then arrange the rest of his mixture according to what he was prepared to spend, less what the wild white clover is going to cost.

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* For fuller particulars as to the Act and the Regulations, and also as to the Official Seed Testing Station, see Form No. 728/C.S., obtainable on application to the Ministry.

Examples of Mixtures.—Seeds mixtures fall into the following classes:—

(*a*) Stubble or autumn bite; (*b*) One-year ley; (*c*) Two-year ley; and (*d*) Three-year or upwards including permanent.

Stubble or Autumn Bite.—More use might be made of stubbles. When stubbles are left idle in order to start cleaning the land at once, well and good, but too frequently they are left untouched until ploughing is begun in late autumn or winter, by which time weeds have got a good hold. If the stubble is clean to start with, then, unless something is grown on it, the winter's rains simply wash out the nitrates. In the south and east of England stubbles are often sown with catch crops such as crimson clover as soon as the corn is harvested. In the north and much of the west, including Wales, owing to the late harvest, the stubbles are almost always left idle until well into early winter. In Wales a plan has been adopted of sowing seeds with the corn, solely for the purpose of providing autumn and winter keep until ploughing. Quick growing red clover and Italian rye grass—the latter especially—have given the best results. Clover is expensive, it does not hold out so well into the winter and it makes harvesting more difficult. And there is the danger of clover sickness. Italian rye grass is free from these disadvantages. A seeding of 15 lb. per acre is recommended, but even 7 or 8 lb. will be useful. It may be sown directly after the corn and harrowed in at the same time.*

One-Year Ley.—There are two main questions:—(*i*) whether stubble and winter grazing are wanted as well as a hay crop, and (*ii*) whether (*a*) one or two hay crops, or (*b*) a hay crop and abundant aftermath grazing, or (*c*) one heavy hay crop, without much stubble grazing or aftermath, be required. Whether Italian rye grass or perennial rye grass should be sown or both, and if both, in what proportions, the farmer himself must decide.

Italian rye grass sown with clover alone does not as a rule give so heavy a hay crop as perennial rye grass with clover, but Italian gives a more leafy hay and does not lodge nearly so readily as perennial. Where stubble grazing is also wanted Italian should be either solely or mainly sown. If Italian and perennial are mixed, the Italian will predominate over the perennial unless only a small amount of the former is sown. Mixing certainly helps to prevent lodging, to afford winter keep and to increase the aftermath, but there is the disadvantage that perennial flowers earlier than Italian.

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* The writer is indebted to Professor R. G. White, M.Sc., for information as to trials conducted by him at Bangor on the question of stubble grazing.

Late-flowering red will generally give a heavier single hay crop than the early reds, but does not contribute so freely to a second hay crop, and is not likely to give so much stubble grazing.

Alsike frequently succeeds better than the red clovers in cold and wet situations, and at high elevations. It is not often necessary to employ other grasses than the rye grasses for one-year leys, but Timothy is useful, and not too expensive, on wet situations and drained peats. Timothy flowers much later than the rye grasses and so is better sown alone than in mixture with them. Tall oat grass may give a very heavy first hay crop, but is expensive, and where the mixture is chiefly rye grass there is no particular advantage in adding it.

The following standard mixtures are only intended to give an idea of the seeding rates which are generally adopted:—

1.—Catering chiefly for a very heavy single Hay crop.

Perennial rye grass	14 lb.
Late-flowering red clover	4–6 „
Alsike clover...	1–2 „

2.—Catering as much or more for Stubble Grazing and Aftermath as for Hay.

Italian rye grass	14 lb.
Broad red clover	4–6 „
Alsike Clover	1–2 „

3.—Compromising between all needs, and being content to have the various species coming into flower over too long a range of time.

Italian rye grass	6 lb.
Perennial rye grass	10 „
Late-flowering red clover	2–3 „
Broad red clover	2–3 „
Alsike clover	1 „

4.—For conditions unfavourable to the Rye Grasses but particularly favourable to Timothy.

(*a*)	Timothy	10 lb.
	Alsike clover	6 „
(*b*)	Timothy	10 lb.
	Late-flowering red clover	4 „
	Alsike clover	2 „

Two-Year Ley.—What has been said about the one-year ley applies in the main to a two-year ley, with the following exceptions:—(i) what counts in a two-year ley is the gross yield over the whole period; it should not therefore be expected to provide continual stubble grazing; (ii) Italian rye grass will not contribute much in the second year, and should therefore be greatly reduced or entirely excluded; (iii) unless aftermath is particularly wanted in the first year broad red clover should be excluded, or only sparingly sown. For a two-years' ley late-flowering red and Alsike are distinctly the proper clovers. A small amount of wild white might be included; it will add to the fertility of the soil and help to suppress weeds.

More money may naturally be spent on a two-year than on a one-year ley, and grasses should be used which will give as high (or higher) yields in the second as in the first harvest year. Thus perennial rye grass may be either wholly or partly displaced by cocksfoot, Timothy or tall oat grass. Whether it should be wholly displaced by whichever of the other three is most suited to the conditions, is difficult to decide. In the interests of gross yield and of getting the included species to flower together, there is much to be said for excluding it, especially on other than the most fertile soils. The question of extra cost (except in the case of Timothy) often decides against leaving out perennial rye grass altogether.

The following is an attempt to indicate "sensible" mixtures for a two-year ley having regard to the considerations discussed. In cases where stubble grazing is urgently needed, 2 lb. of Italian rye grass might be added to each:—

1.—*For soils where Perennial Rye Grass is known to hold well into the Second year.*

Perennial rye grass	14 lb.
Late-flowering red clover	4–6 ,,
Alsike clover	1–2 ,,
Wild white clover	¼–½ ,,

2.—*For soils where Cocksfoot bulks very much more heavily in the Second year than does Perennial Rye Grass.*

(*a*)	Cocksfoot	10 lb.
	Timothy	4 ,,
	Late-flowering red clover	4–6 ,,
	* Alsike clover	1–2 ,
	* Wild white clover...	¼–½ ,,
(*b*)	Perennial rye grass	8 ,,
	Cocksfoot	8 ,,
	Timothy	3 ,,
	Late-flowering red clover...	4–6 ,,
	* Alsike clover	1–2 ,,
	* Wild white clover...	¼–½ ,,

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* If a reliable strain of late-flowering red (of the Montgomery type) is employed, then to save expense Alsike clover and wild white clover can be omitted; the Montgomery should ensure a sufficiently good clover root to plough down at the end of the second year.

3.—For soils particularly adapted to Timothy.

Timothy	10–12 lb.
Alsike clover	4–5 „
Wild white clover	¼–½ „

Note.—Since Timothy flowers so much later than other grasses a combination with rye grass is not here recommended. Alsike clover and Timothy agree well together, and the inclusion of Alsike to the total exclusion of late-flowering red clover renders the mixture an exceptionally cheap one.

4.—Where from local evidence it is desired to rely wholly or largely upon Tall Oat Grass.

(*a*)	Tall oat grass	16 lb.
	Late-flowering red clover	4–6 „
	Alsike clover	1–2 „
	Wild white clover	¼–½ „
(*b*)	Perennial rye grass	8 „
	Tall oat grass	8 „
	Late-flowering red clover	4–6 „
	Alsike clover	1–2 „
	Wild white clover	¼–½ „

Note.—Tall oat grass has the advantage of providing very early keep in the spring, but if heavily grazed at that period the grass is quickly killed out. The above mixtures are probably prohibitive in price unless the circumstances are exceptional—evidence, however, suggests that small sowings of tall oat grass are seldom satisfactory or profitable.

Long Duration Leys and Permanent Grass.—The mixtures required to produce a good ley for three years and upwards differ little from those required for a permanent sward. The reason of this is that, for the sake of fertility, there should always be a good sward full of clover to plough down when a ley of three years or upwards is broken. Again, in a field that has been down for about six or more years, the herbage will fall into two classes. Much of it will consist of wild plants which have established themselves naturally, and only a part of it of plants which were sown in the original mixture and have become permanent. These latter plants are, moreover, just those which should usually be sown for a ley of three years and upwards.

In all long duration mixtures the object should be to get a good "sole" as soon as possible and to crowd out weeds and bent grass. To this end wild white clover, perennial rye and rough-stalked meadow grass work admirably together.* For providing a good "adult" sward, wild white clover is essential.

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* See, for instance, "Formation of Perennial Pastures" in Reports on Experiments for 1920–21, Department of Agriculture, University College of North Wales, Bangor.

How much should be sown is not so easy to say. As little as ¼ lb. has proved sufficient to get a quickly formed sole, and as much as 4 lb. has justified its cost. Opinions differ whether the "sole" will suffer by taking a heavy first hay crop from a field sown for a long duration sward. With a good "take" and good harvest weather the formation of "sole" is not likely to suffer. On the other hand, plot trials in Wales have clearly shown that if the hay crop is exceptionally heavy and the harvest weather bad, wild white clover may be to a large extent killed out, even when the original take has been excellent.

There are two classes of long duration mixtures:—(1) Those from which a first hay crop, and also, if required, later hay crops may be taken; these will usually be sown under corn. (2) Those sown for grazing only; such mixtures are frequently sown on poor, outlying fields, from which corn will not be taken, and are sown without a covering crop or under rape.

(1) *Mixtures designed to give Hay and Pasture.*—The following mixture, advocated by Professor Gilchrist, has been found, over a wide range of country, equally suitable for a three-year ley or for permanent grass. It may be taken as an example of the simple mixture, although the seedings are rather heavy, and may be altered to suit various districts and conditions:—

Perennial rye grass	16 lb.	True late-flowering red clover	4 lb.
Cocksfoot (New Zealand) ...	10 „	Trefoil	1 „
Timothy (Scotch)	4 „	*Wild white clover	1½ „

In many districts trefoil cannot be relied upon; thus, under the conditions of high rainfall and non-calcareous soils which prevail over large areas in Wales and the west of England, this species but seldom succeeds and should not be included in the mixture.

The following are suggested as "sensible mixtures" for such districts; to either of them not more than 2 lb. of Italian rye grass may be added where sheep are kept during the winter and the fields are likely to be heavily grazed during the first autumn and winter after sowing:—

(a) Simplified as much as possible.

Perennial rye grass ...	12 lb.	Late-flowering red clover (Welsh)	4 lb.
Cocksfoot (New Zealand)	8 „	†Alsike clover	1–1½ „
Timothy	4 „	Wild white clover... ...	¼–1½ „

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* In many cases the wild white clover might be reduced to ½ lb.

† Where red clover invariably takes well, Alsike can often safely be left out. At high elevations (above 600–700 ft.) Alsike often does very well and may sometimes altogether replace late-flowering red.

(b) Rather more complex.

Perennial rye grass	8 lb.	Alsike clover	1–1½ lb.
Cocksfoot	6 ,,	Late-flowering red clover	4 ,,
Timothy	4 ,,	Wild white clover ...	½–1½ ,,
*Rough-stalked meadow grass ...	1½ ,,	†Chicory	1–2 ,,
*Crested dog's tail	1½–2 ,,		

Where cocksfoot predominates in mixtures for leys two rules should be observed. First, the hay should be cut comparatively early, before the seed has begun to develop and ripen. Secondly, the swards should be grazed hard at least once a year. If hay has been taken, this can be done on the aftermath.

Some will object to the amount of cocksfoot in the mixtures above, but until further trials have been made it is hard to suggest anything else but cocksfoot if hay is required on soils where perennial rye grass is not productive after the second year. Golden oat grass, sown thickly, would probably meet the case, but it is expensive and usually of low germinating capacity. Timothy might completely take the place of cocksfoot in some cases, but those who object to cocksfoot, generally object to Timothy in quantity. The same may be said of tall fescue which, furthermore, is expensive. This last is, however, capable of thriving on many classes of poor soil and of providing relatively abundant late winter and early spring keep.

On more fertile soils where perennial rye grass holds longer, the best substitute for cocksfoot is undoubtedly meadow fescue. Farmers might try a small area with mixture (*a*) reducing the rye grass to 8-10 lb. and sowing meadow fescue (about 8-10 lb.) instead of cocksfoot. On excessively thin and dry soils in regions of low rainfall it is probable that smooth-stalked meadow-grass (*Poa pratensis*) and Chewings fescue may sometimes be helpful. The latter grass is, however, frequently of very poor germinating capacity and thus, from the point of view of establishing a take and of resisting subsequent competition, needs, if included, to be sown in considerable amount. In such situations there is little doubt that ribgrass (*Plantago lanceolata*) is a really valuable plant and may be included in the mixture.

In the case of all the above mixtures, short and long alike, the quantities given are for broadcasting—not drilling—under a corn crop, on an average tilth as regards weeds and suitability for the seeds. Under these conditions there is bound to be a waste of seed.* A farmer who has carefully studied the date and methods of sowing and covering seeds might often quite safely reduce the quantities.

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* These two grasses have both done well, especially on soils too poor to carry a permanent rye grass herbage. If both are sown, 1½ lb. of each would be the outside sowing. If only one, then 2 lb. would not be too much.

† Chicory is sometimes objected to in the hay, but on many soils persists well and gives excellent spring grazing.

(2) *Mixtures designed to give Grazing only.*—In a mixture designed for grazing only, there is no absolute need to sow the "coarser" hay grasses and no risk of the hay crop hampering the wild white clover. There is also an advantage in sowing otherwise than under a corn crop. There is no danger to the grass from lodged corn; there is time to clean and prepare the land thoroughly; and the sowing can be done at the most favourable moment. Consequently seedings may be reduced.

The following mixtures are perhaps still in the experimental stage and are offered for trial as suggested on page 130. It is suggested that the mixtures should be sown under about 2 lb. of rape per acre or without any covering crop:—

1.—Perennial rye grass ...	10–12 lb.
Wild white clover ...	2–4 ,,
2.—Perennial rye grass ...	10–12 ,,
Late-flowering red clover (Welsh) ...	4 ,,
Wild white clover ...	2 ,,
3.—Perennial rye grass ...	8 lb.
Rough-stalked meadow grass	4 ,,
Wild white clover... ...	2–4 ,,
4.—Perennial rye grass ...	8 ,,
Rough-stalked meadow grass	4 ,,
Late-flowering red clover (Welsh)	4 ,,
Wild white clover	2 ,,

The above mixtures would almost certainly be more applicable to regions of high than of low rainfall, and in the case of each, if it is intended to use the fields for heavy winter and early spring grazing with sheep, the addition of a few pounds of the coarser grasses, such as cocksfoot and Timothy, would perhaps be an advantage.

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CRIMSON CLOVER.

T. Wibberley, M.I.A., F.L.S.

The growing of Crimson Clover or Trifolium (*Trifolium incarnatum*) is at present more or less confined to the southern counties of England. In this area the crop is usually grown on stubble land after winter cereals. Many unsuccessful attempts have been made to grow it in the west and north, but the failures have probably been due to the fact that the spring cereals after which the trifolium has been sown, are harvested too late for the successful sowing of this crop. It has now been proved over wide areas that winter oats, and on light soil winter barley, can be just as successfully raised in Northumberland as in Hampshire, provided the corn is sown early, preferably in late August or early September, and if necessary grazed back before winter. These cereals, when sown early, will ripen two or three weeks earlier than spring sown corn, and often the stubbles can be cleared in sufficient time to sow trifolium. Generally, however, it is not wise to sow it in the north of England later than, say, 10th September, and in the south of England later than 20th September.

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* See this *Journal*, April, 1922; May, 1922; and March, 1923.

Varieties.—There are three varieties of trifolium, viz., early, medium, and late, and in addition also a white flowering variety. If the three varieties are all sown at the same time, they come in for use at different times in the following summer, but the same result may be achieved by sowing any one of the varieties at intervals of from seven to ten days.

Preparation of the Land.—The main essential for the successful growth of crimson clover is a firm seed bed. For this reason when sown on stubble land, anything in the nature of elaborate cultivation is a disadvantage. If the land is ploughed and worked to a fine seed bed the crop usually fails. All that is needed is to give the stubble one or two runs with the drag harrow, or for preference a spring tooth harrow, then broadcast the seed and roll. A similar method can be followed when the crop is sown in summer, say, on a vetch and cereal stubble when the latter crop has been cut for hay or silage or fed off with sheep. Again, the crop can be successfully grown with spring sown lea oats, the seed being sown when the corn is brairded, and chain harrowed and rolled.

Sowing on corn or vetch stubble as described above necessitates fairly clean land. Where the land is foul and it is desired to sow the crop in summer or early autumn, it is wise to sow a little white mustard along with the crimson clover to keep the land covered-in until the crimson clover is established.

Rate of Seeding.—The common method is to sow from 20 to 24 lb. per acre, but this method has many drawbacks. If the crop for any reason fails, there is nothing to fill up the land, whereas if it succeeds and the area sown is considerable, long before the crop can be consumed it is so thick that it rots at the bottom, making it difficult to convert into hay. It is also very necessary to emphasise the fact that there is the greatest danger in feeding crimson clover (especially to young lambs) when the flowering period has reached an advanced stage. The florets of crimson clover are very hairy in the advanced stage, and if fed to sheep cause the formation of hairballs, which result in obstruction in the digestive tract. "Hairballing" is also common amongst horses which have been fed on crimson clover hay made from over-ripe trifolium. A more useful crop for folding off with sheep or pigs, or for conversion into hay or silage, and also a surer crop, can be obtained by sowing on a corn or vetch stubble about 14 lb. of Italian rye grass, and 10 to 12 lb. of crimson clover per acre. On foul land 6 to 10 lb. white mustard can also be included in this mixture.

When sown with lea corn or autumn or spring sown tares on firm land, the rate of seeding should be about 14 lb. of Italian rye grass and 7 lb. of crimson clover. Another very marked advantage of sowing smaller quantities than is usual of crimson clover along with Italian rye grass is that often two crops can be obtained from the one cultivation and seeding. For instance, sown in autumn on stubble land the crop can be folded off in May or early in June and then refolded in September. Where this system of double feeding is practised, it is necessary to modify somewhat the system of folding.

The usual custom in districts where crimson clover is grown is to hurdle on small areas of land a large number of sheep which bite and tread the heart out of the clover. No second growth results except on very good land, and under ideal conditions of growth. Even when a second crop does follow close folding, sheep will not eat it down a second time, though pigs will

The writer's method of folding is to use a combination of sheep netting and hurdles. For, say, a flock of 500 sheep, netting is placed round 10 acres in the form of an oblong 100 yards wide. The hurdles are placed crosswise at right angles to the long sides of the plot so as to enclose one or two acres. As the sheep eat down the plot, the cross hurdles are moved on, and the enlarged fold left for the sheep to wander over. As a result, after a few days' folding, instead of the sheep being confined to a small area, they have a considerable run of ground. The crop in consequence is not eaten down too bare, nor the land unduly trampled or soured.

Manuring of the Crop.—Quite a number of failures of crimson clover which have come before the writer's notice have been due to improper manuring of the crop. In fact, speaking generally, crimson clover is either insufficiently manured or not manured at all, yet there are few crops that will pay so well for a liberal dressing of artificials. It may also be stated that in the case of leguminous crops, there exists a very prevalent opinion that nitrogenous manures are not required. It is true that crimson clover, in common with other leguminous crops, has remarkable power of gathering free nitrogen from the atmosphere, but the writer's experience has led him to the very definite opinion that the discreet use of nitrogenous manures on nitrogen-gathering crops, by increasing the vigour of the crop, also increases the capacity for assimilation of nitrogen from the atmosphere.

It is very commonly known among farmers that clovers are nitrogen-gatherers, but very few farmers realise to what extent the growing of a clover crop enhances the fertility of the soil. In an article recently published Corrie emphasises the above point in an admirable manner. He states that:—

> "The roots of one good clover crop in England (*i.e.*, the residue) were found to weigh when dried, 6,503 lb. per acre, and to contain 65 lb. nitrogen and 27 lb. phosphoric acid per acre. At Rothamsted, in an experiment comparing the effects of bare fallowing and cropping with clover, the following figures show the results obtained per acre throughout a rotation of swedes, barley, clover or fallow, and wheat:—

Plot.	*Clover Hay.* cwt.	*Wheat.* bus.	*Swedes.* tons.	*Barley.* bus.
Clover Plot	76·7	39·5	19·4	36·3
Fallow Plot	—	32·5	19·0	28.3

> Although nearly four tons of clover hay were removed, the residues or roots and stubbles were sufficient to increase the wheat crop by 21 per cent., the root crop by 2 per cent., and finally the barley, three years later, by 28 per cent."

Professor Neale, Delaware Experimental Station, states:—

> "8·3 tons crimson clover, grown from seed which cost 4s. 2d. per acre, added 24 bushels to the corn crop; 4s. 2d. invested in nitrate of soda and used as a top dressing added six bushels to the corn crop. It should be remembered also that the corn crop does not exhaust the whole of the nitrogen of the clover, whilst the nitrate of soda has no value after the one crop (and may even have an exhausting effect). None of the quick-acting nitrogenous manures will improve the texture of the soil, or supply organic matter. Often enough their use is harmful. The value of the legumes in the rotation should never be forgotten."

Another decided advantage of using nitrogen in the manuring of a mixture of crimson clover and Italian rye grass is that so doing ensures early feeding. On 6th March last the writer had two fields which were sown in autumn with a mixture of crimson clover and Italian rye grass. Field No. 1 at the time of sowing (late August) received a dressing of 1 cwt. Nauru phosphate, 2 cwt. superphosphate, and 2 cwt. kainit per acre. During the first week in February the crop received an additional dressing of 1 cwt. sulphate of ammonia and 1 cwt. nitrate of soda per acre. Field No. 2 was not manured in February. There was a good stand in both fields, but the February manured field was ready for folding off by the first week in April, whilst field No. 2 will probably not be ready until the first or second week in May. It might also be mentioned that since field No. 1 was previously cropped with corn, and No. 2 had had a tare crop consumed on the land, of necessity the latter field must have been in the better heart. Liberal manuring not only ensures a fuller and an earlier first crop, but a more vigorous second crop where it is left for refolding, which in turn invariably results in a more vigorous follow-on crop. Another point well worthy of special mention is that liberal manuring, especially where nitrogenous manures are used, results in the crop remaining succulent for a longer period than an unmanured crop.

Generally speaking, a suitable dressing for crimson clover on a corn or vetch stubble is 3 cwt. superphosphate, 3 cwt. kainit, and ¾ cwt. sulphate of ammonia per acre. This manure should be applied at the time of sowing or as soon after as possible. Where a large area is sown for successional feeding it is a very good plan to give further dressings of nitrogenous manure—either nitrate of soda or sulphate of ammonia—in early spring. The first dressing might be applied about mid-February and the second and third at fortnightly intervals. There is a very prevalent opinion among shepherds that spring dressings of nitrogenous manures on crimson clover are apt to cause scour amongst the ewes and lambs. This opinion has some foundation, but the fault is not attributable to the use of artificial manures, but to the indiscreet use of the crop. Any succulent green crop will scour sheep if fed in excess, and without some corrective food in the form of hay or crushed oats mixed with a little cotton cake. Also the sheep should not be allowed to go on to a new fold of any kind of crop until the frost has cleared off.

Crimson Clover and Continuous Cropping.—Crimson clover is a crop which fits in well with the continuous cropping system which the writer has so long advocated. The crop can be introduced at various periods in suitable rotations, of which two examples will suffice. On one section of the farm the writer carries out the following rotation:—

1st year ...	1st crop ...	Autumn cereals.
2nd „ ...	2nd „ ...	Crimson clover and Italian rye-grass, autumn sown.
	3rd „ ...	Mixture of mustard, hardy green turnips, rye-grass and clover.
3rd „ ...	4th „ ...	Seeds hay, aftermath grazed.
4th „ ...	5th „ ...	Wheat with seeds.
5th „ ...	6th „ ...	One year's ley.

In the above rotation the crimson clover and Italian rye-grass are folded off from April to the end of June, and as each section is fed off the land is immediately ploughed up and sown down with a mixture of from 10 to 12 lb. white mustard, 3 lb. hardy green turnips, 14 lb. Italian rye-grass and 4 lb. crimson clover, per statute acre. The mustard crop keeps the land covered in until the hardy greens and grass seeds are established. During wet harvest weather the mustard is cut green and made into stack silage, then the hardy green turnips are fed off in the following spring time, and the rye-grass and clover seeds are hayed in late June, the aftermath from the latter crop being folded off and the land ploughed up for wheat.

Another continuous cropping rotation including crimson clover is as follows:—

1st year ...	1st crop ...	Autumn tares mixed on lea, folded off in early summer.
	2nd " ..	Crimson clover and rye-grass, folded off in autumn.
2nd " ...	3rd " ...	Crimson clover and rye-grass, hayed or ensiled early summer. Hardy green turnips sown in rows, thinned out by harrows ; small plants left.
3rd " ...	4th " ...	Small plants folded when bolted in spring.
	5th " ...	Spring tare mixture and grass seeds. Former cut for hay in July.
	6th " ...	Aftermath grazed.
4th " ...	7th " ...	Seeds hay.
	8th " ...	Aftermath grazed.

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THE "RING-SPOT" AND "RUST" DISEASE OF LETTUCE.

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IN December last we received a number of lettuce plants from a farmer at Swanley, in Kent, with the information that whole fields of lettuce were being attacked by a disease which was rendering the plants unsaleable. Some of the specimens sent bore the two fungi commonly associated with disease in lettuce, viz., the Downy Mildew (*Bremia lactucae*) and the grey mould *Botrytis* (commonly called " mildew " by the grower), while one plant was affected by a bacterial rot. In addition, however, there were symptoms of a disease new to us, and this appeared to be responsible for the greater part of the damage done to the plants. An inspection of the fields was made, and the fact ascertained that while the *Bremia* and *Botrytis* were not causing an appreciable amount of harm, the new disease (*Marssonia panattoniana*, Berlese) was occurring on an epidemic scale and was threatening the very existence of the lettuce-growing industry.

Description of the Disease.—The affected plants in the field are attacked on the leaf-blade and on the leaf-stalk. On the leaf-blade the disease is manifested by very characteristic perforations, each bordered by a white line. These perforations had attracted the notice of the grower and, very naturally, had led him to suppose that the plants were being attacked by some insect which was eating out minute holes in the leaf. This injury is, however, entirely the work of a fungus. The diseased areas on the leaf first appear as brown spots, having the appearance of being water-soaked; these usually soon become white with the spores of the fungus (*Fig. 1*). As the spots reach a diameter of $\frac{1}{8}$ in. or so, the central dead portions drop out, leaving the characteristic perforations (*Fig. 2*). The name "ring-spot" disease appears suitable to designate this form of injury which strikes the eye of the grower as he walks over the field.

When infection occurs on the midrib of the lettuce leaf (which takes place particularly on the underside and near the base) the spots instead of remaining circular, become elongated and form elliptical brown sunken patches (*Fig. 3*), at first sight giving the impression that the tissues have been eaten out by a slug. At these places the superficial layers of cells are killed and collapse and turn a rusty brown (which intensifies in colour after the lettuce plants have been packed), and thus blotches arise which render the lettuce unsaleable or greatly depreciate its market value. The name "rust" is used by the grower to designate this form of injury.

A microscopical examination showed that the white rim to the circular perforations on the leaves was due to the production of a mass of spores of the minute fungus, *Marssonia panattoniana*, which has not hitherto been reported from this country, except in a single instance in a glasshouse (see p. 149).* The same fungus was found producing its spores on the elliptical spots on the midrib. The spores are borne on short stalks which arise from a loose weft of fungal threads. The spores are colourless when seen singly, but appear white when seen in the mass; each is club-shaped, minute (about 15 by 3 μ) and divided by a cross-wall into two cells. They are produced in immense numbers, and when rain falls on the leaves it

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* We are indebted to Miss E. M. Wakefield, at the Herbarium, Kew Gardens, for assistance in consulting the literature dealing with previous outbreaks.

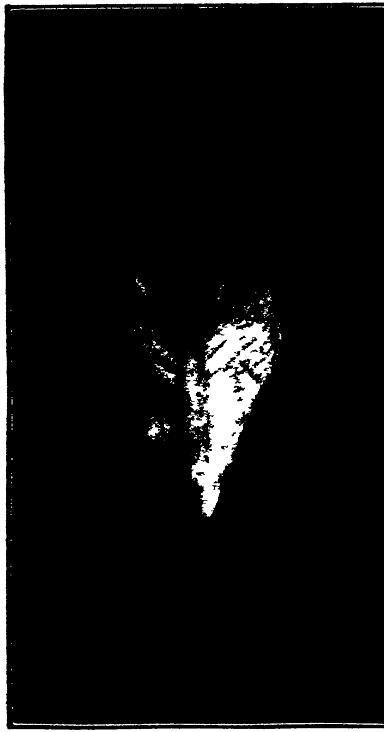

FIG. 1.—Early stage of the "Ring-spot" condition: the spots are white with spores.

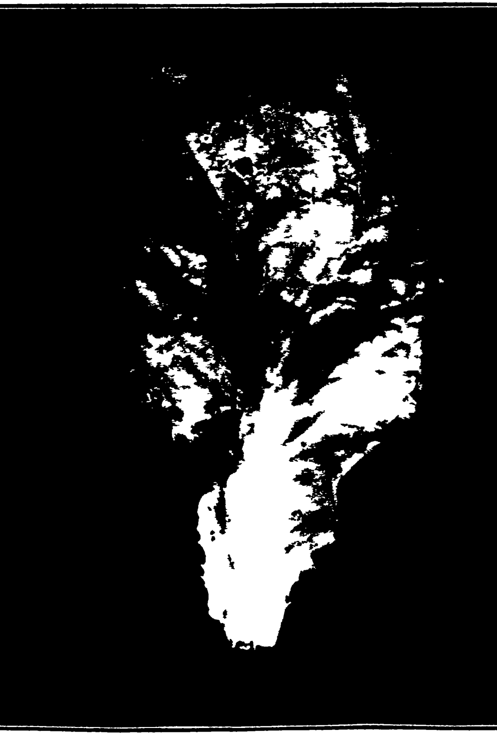

FIG. 2. Typical "Ring-spot" stage: the central portion of each spot has fallen out, leaving a perforation.

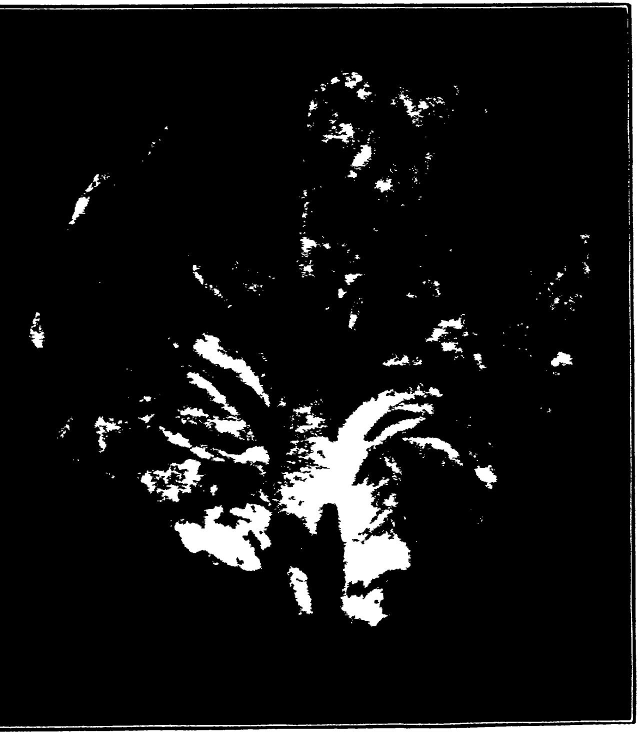

FIG. 3. –The "Rust" stage, seen as brown, sunken, elliptical patches on the mid-rib. The brown patch at the base is caused by the fungus.

washes the spores down towards the crown of the plant and so the stalk portions of the leaves become infected, resulting in the withering of the older leaves and the infection successively of the younger ones.

Nature and Extent of Damage.—The grower stated:—"In the spring of 1922 there was no end of this trouble. I planted out 8½ acres of cabbage lettuce, and they are so badly attacked that we shall have to plough them in. . . . I have this year (1922) had upwards of 20 acres that has been practically valueless owing to this trouble. Five acres of Hardy Winter White Cos are now (February, 1923) becoming infested with the disease During the year we grow, perhaps, 40 acres of lettuce. We do not as a rule use the same ground continuously for lettuce, though where we have done so we have found no ill effects until lately. The soil is loam, with good drainage. The varieties attacked have been 'Trocadero' (cabbage) and 'Lobjoits Green' and 'Hardy Winter White' (cos). I have not heard of the occurrence of the disease elsewhere than on my farm. I do not use boxes from salesmen, but sell all my own lettuce in my own boxes. I have had a lot of vegetable matter come in the rough dung I have from London. This is refuse cleared up from markets, etc. I have no doubt we have had lettuce in this that have been thrown away from some cause or other. I have an idea that this is where the disease has come from. Large quantities of lettuce are imported from France from early autumn until late spring and from Holland all through the spring while they pay to send."

No definite information is available as to the way the disease has been introduced into this country, but the fact that lettuces are imported from the Continent (where the disease exists) and that market refuse is carried out into the country for use as manure provides a very possible explanation.*

Circumstances attending Outbreaks of the Disease in other Countries.—The present disease has only once been previously reported in this country, viz., by Mr. F. J. Chittenden, in 1912,† on lettuce plants ("Early French Frame Forcing") in a glasshouse at Haslemere, Surrey, when "about a quarter of the crop" was attacked. A warning was given by Mr. Chittenden, that as the disease was likely, under certain conditions, to assume an epidemic form, a sharp watch for it should be kept by growers of lettuce. Mr. Chittenden informs us that no further cases have come to his notice.

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* We have been informed by the Ministry of Agriculture that lettuces are imported into England from France, Holland and the Channel Islands.

† *Jour. Roy. Hort. Soc.*, Vol. XXXVII, p. 541.

The outbreak in Kent[*] is the first recorded case of the disease appearing on lettuces in the open in this country, and since growers in this country have had no experience of this fungus disease, the circumstances attending outbreaks of it in other countries are worth noting. The disease was first noticed[†] in Italy (in the neighbourhood of Pisa) in 1894, in the form of spots on the leaf-blade and depressions in the nerve of the leaf. The fungus causing the disease was found to be a species of *Marssonia* new to science. The disease was observed to start on the outer leaves, then to spread gradually to the innermost leaves of the "heart" of the lettuce, when the whole plant died. It was first noticed at the end of January; it continued to thrive throughout February and played havoc to the end of March. Several thousands of lettuce plants were destroyed in the gardens affected.

The next outbreak was reported[‡] from Germany in 1907, although the investigations showed that the fungus had been in that country for some years previously, escaping observation and spreading little by little until the epidemic in 1907 took place. In the neighbourhood of Berlin the cultivation of lettuce was being carried out on a large scale for the Berlin market. At the height of the season 25 to 30 truck-loads of lettuce were sent in daily by railway to the market. The lettuce was sown in frames in November and December, and the young plants transplanted to the field as soon as possible in the first warm days in March. The same fields were used continuously for lettuce growing, and the remains of lettuce plants lay about on the soil and were dug in. Under these circumstances very favourable conditions obtained for an epidemic of the disease when the fungus reached the neighbourhood. Many growers lost several thousands of their plants; it was estimated that from 50 to 60 per cent. of the plants became affected, the earliest and most valuable part of the crop suffering most. Corresponding to the colder climate of Berlin, as compared with that of Pisa, the disease appeared later in the season, *i.e.*, in April, and continued to the end of May. Plants in the frames as well as in the open were attacked. In warm, dry weather those leaves of a plant which were already attacked perished, but notwithstanding a saleable lettuce was produced; if damp weather came on, however, a further development of the fungus took place, and the disease assumed epidemic proportions. Even when the disease was limited to spots on outer leaves the lettuces suffered so much in general appearance that their market value was greatly lowered.

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[*] Examples of the disease have now (April) been sent to us from Greenhithe, N. Kent.

[†] Berlese, A.N. Un nuovo marciume dell' Insalata (*Lactuca sativa*). Rivista di Patologia vegetale, III, 339 (1894).

[‡] Appel, O. und Laibach, F. Arbeit. Kaiserl. Biol. Anst. f. Land-und Forstwirtschaft, Bd. VI, 1908. 28–37.

In 1899 the disease was reported by Oudemans,[*] from Holland (Nunspeet), on lettuce, and also, in 1903, on endive. In 1915, Ritzema Bos recorded[†] the occurrence of the disease on endive in several localities in Holland, during October and November, 1914. In one case a crop of 5,000 plants was wholly lost.

In France the disease has been reported by Marchal and Foex,[‡] from Châteaurenard-Provence (Bouches-du-Rhône), in 1913, but no details of the outbreak have been published.

The only other country in which the disease is known is the United States. It was found there first in 1895, in Ohio, and has since occurred in a few other States. It has been called various names in America, *e.g.*, "shot-hole," "leaf-perforation," "rust" and "anthracnose," and is not uncommon there as a greenhouse pest,[§] but few epidemic outbreaks have been reported.

Control Measures.—No opportunity has yet existed in this country for ascertaining what measures for preventing or controlling the disease are practicable. The following information on the subject published by investigators abroad is worth noting:—As the disease is usually continued from the remains of a preceding diseased crop, a system of rotation should be adopted to eliminate this danger. Manure containing lettuce refuse should not be used. In the frame or greenhouse, watering should be carried out in a way to prevent the splashing of water from plant to plant or from leaf to leaf. As far as possible the beds should be inspected early and any diseased plant promptly removed and burnt, as one plant with the disease can become a centre of infection which may involve a whole bed

Spraying the plants (when young) with Bordeaux mixture or ammoniacal copper carbonate has been recommended, but does not appear to have been anywhere practised.

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[*] C. A. J. A. Oudemans. in Nederlandsch Kruidkundig Archief. III serie, 2e deel, pp. 297 and 1117 (1902).

[†] J. Ritzema Bos, in Tijdschr. over Plantenziekten, XXI, 169 (1915).

[‡] P. Marchal and E. Foex, in Annales du Service des Epiphyties, II, 32 (1915).

[§] Brandes, E. W., Anthracnose of lettuce caused by ***Marssonina panattoniana.*** *Jour. Agr. Res.* XIII, No. 5. Apr. 1918, pp. 261–280. (References to previous outbreaks in the United States are given in this paper.)

POULTRY-KEEPING AT A FARM INSTITUTE.

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POULTRY-KEEPING has many claims to be considered as a separate and distinct department of a farm institute. While the chief appeal of the farm institute as a whole must be to the farmer, and especially to the larger and more up-to-date farmer, the main bulk of the persons interested in poultry-keeping are not farmers at all or are farmers only of small areas. Students attending the farm institute may be expected to make very varying demands on the poultry department, according to their prospects and intentions in life. The "farming student"—the son of the larger farmer—may desire but a nodding acquaintance with the subject, but to others, poultry-keeping may be the chief concern in a course of instruction. Some indeed, if their requirements are fully met, will need a course in which poultry-keeping replaces agriculture.

Further, poultry-keeping as a subject of instruction can be, and needs to be treated from a standpoint different from that which the teacher of general agriculture commonly adopts. The immense changes in poultry-keeping practice during the past two decades have placed a great gulf between the older methods and the new; a gulf which many poultry-keepers have not as yet crossed.

It appears to us therefore that poultry-keeping is a subject in the teaching of which practical work and practical demonstration should be the keynote; and that an institution endeavouring to teach poultry-keeping should be equipped with an up-to-date department of reasonable size. A self-contained department possesses obvious advantages over a department consisting of a fragment or fragments of the farm, with a lien on portions of the farm buildings.

At the Cheshire School of Agriculture it has been possible to set apart a small dairy holding of about 5 acres (nearly all in grass) which lay in the Reaseheath estate within convenient distance of the hostel and laboratories. The land is divided by a high road into two crofts, the smaller of the two—some 1½ acres—containing the smallholder's house, outbuildings and garden. The whole area is on light drift soil overlying New Red Sandstone.

Organisation.—In designing the lay-out we have been influenced by several considerations, viz. :—

1. While due regard must be paid to the expense both of equipment and of maintenance, a teaching department must be equipped in a manner which permits of good teaching. Provision must, for instance, be made for a much greater variety of work than would ordinarily be undertaken on a commercial place of the same size. Provision must further be made for instruction of a very varied nature—the resident student will need one thing, the casual visitor another.

2. Every live teaching institution must be equipped to carry out original work of some kind. While research in the present-day restricted meaning of the term is not usually considered as within the scope of work of a farm institute, provision must be made for investigations of a minor character. Poultry-keepers are in dire need of accurate statistical records in many departments of their business, and at least this type of work should be provided for.

3. A practical department must act as its own advertisement. It must be prepared for criticism from all sides. Not all of the people who visit farm institutes come to admire the places which public expenditure have called into being. Good stock and up-to-date plant are essential; and the premises must be kept presentable and clean beyond the real necessities of healthy life.

4. The place must be kept within the compass of the labour available. This fitting of the place to the labour, and *vice versa*, constitutes a great difficulty. Student labour is a very variable factor. Equally difficult to estimate is the absorption of a manager's time by appointed or casual visitors. Not only are there organised parties to cater for, but there are many small parties as well as small purchasers to reckon with. Few people buy a cockerel or a dozen chicks of a County Council poultry station without occupying the manager's time on one pretext or another for a considerable space. No commercial undertaking could afford to devote to casual purchasers the time which an educational institution must perforce spend on them. The value of the goods sold is too small. There seems no way out of this difficulty, though the difficulty is certainly minimised by making the station as far as possible self-explanatory.

Reaseheath station has been divided into sections as follows :—

1. Incubation and rearing (and table poultry production).
2. Varieties and breeding.
3. Commercial egg production.
4. Intensive management.
5. Ducks and other waterfowl.

The department at its inception took over a small flock, and a certain amount of plant which had been maintained on Henhull Hall Farm during the War for the purposes of the Egg and Chick Distribution Scheme. As soon as possession of the holding was obtained a poultry-man was appointed to live in the house, and to be responsible for the day to day management of the station, under the superintendence of the County Poultry Instructor.

Incubation and Rearing.—The incubating room consists of a small cow-byre from which the stalls have been removed. It was necessary in adapting this building to relay the floor with concrete and to make certain small alterations to improve ventilation and lighting, but the whole of the adaptation was carried out for a comparatively small sum. Four types of machine—Hearson, Gloucester, Triumph and Glevum—are worked. The smaller machines, especially those taking only 100 eggs, prove much the most satisfactory for teaching purposes. Detailed records of the results obtained with the various machines and eggs at different dates are kept, and useful statistics are thus being collected.

The rearing section calls for little description. The newly-hatched chicks are transferred to brooders or hovers on grass immediately adjoining the incubator room. On leaving the brooders they are transferred to pens on cultivated land which occupy the remainder of the croft adjoining the poultryman's house. Later in the year these pens serve for accommodating surplus cockerels which are ultimately fattened.

Houses and Runs.—Twelve pens, each measuring about 20 yd. by 12 yd. have been laid out in line, along the roadside edge of the larger croft. The houses are arranged in pairs, and are of five patterns. While this variety of type militates to some extent against the appearance of the place, it possesses obvious educational advantages. Practically all the houses are directly accessible from the gangway. Trap-nests are fitted to most of these houses, and are being introduced into all. They are littered throughout with wheat straw, which possesses the advantages of durability and freedom from dust. In erecting the pens strong posts 5 to 6 in. square, with straining posts, were dug in at the corners of each pen, and 2 in. by 2 in. droppers of creosoted red deal were driven in at 10 ft. intervals. A galvanised iron straining wire was then fixed along the tops of the posts, and proved of material assistance in reducing buckling of the netting to a minimum. The runs were fenced with two 3 ft. widths of netting, the upper being of 3-in. mesh and the lower 2½-in. The upper width was put on first, and the lower width let into the turf to a depth varying with the surface of the ground. In hollow places, short lengths of appropriate width were fixed to the bottom of the lower strand. It might here be remarked that the deal posts, creosoted under pressure and bought in bulk, were the same relative price as smaller quantities of uncreosoted material bought about the same time.

Varieties and Breeding.—We have had some difficulty in deciding on the number of breeds to be kept, as the needs of education and of economy in management to some extent clash. The breeds eventually decided upon were:—White Leghorn, Black Leghorn, White Wyandotte, Rhode Island Red, Light Sussex, Speckled Sussex and Ancona.

Commercial Egg Section.—One acre in the same croft has been wired in, and divided into two runs, for the purposes of this section. It was originally proposed to plough this area, but as grassland in the county is highly productive, and as, moreover, the relative possibilities of arable and grassland are being tried on a large scale in another department, the land has for the time being remained in grass, the two sections being grazed alternately. A large laying house, built from plans supplied by the Ministry of Agriculture and Fisheries,* occupies the centre of the area. This house is of the ¾-span type and embodies the ridge ventilation of the span roof, with all the advantages of the lean-to pattern. Of the 150 birds kept therein since it was put up 18 months ago, only one has shown any symptoms of cold, and the house has met with very general commendation from the large number of visitors who have inspected it. We have some confidence therefore in describing it as a very satisfactory house.

Some trouble was at first experienced from the burrowing of the fowls in the vicinity of the house, with consequent necessity for frequent patching. The difficulties incident on allowing birds to get under houses for this purpose are too well known to need description, and we have therefore sought another remedy in wiring round the bottom of the house with ½-in. netting which is sunk in the ground to a depth of 1½ ft. and by the provision of a small dust bath in each run. These baths have been made by digging out holes 2 ft. by 6 ft., and about 18 in. deep, bricking the sides and covering with a sheet of galvanised iron on four short posts. A barrow load of fresh sand has to be put in occasionally.

Intensive Management.—The variety pens and laying flock together occupy about two-thirds of the larger of the two crofts of which the station consists. The remaining portion, about an acre in area, is wired round and in the latter part of the summer used for young stock at semi-free range. In the first half of the summer crop of hay is taken. A Hannaford house, 16 ft. by 10 ft., has recently been erected in the centre of this area, and will be used for intensive purposes during the growth of the hay crop. After the hay is removed it will be utilised for young stock. The Hannaford house is of the lean-to pattern, and built of 1 in. timber, but is otherwise similar to the large laying house already referred to.

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* The following plans can be obtained from the Ministry:—No. 1, Laying house (11ft.); No. 2, House for 25 birds (or double breeding pen); No. 3, House for 6 to 9 birds; No. 4, Hen house (8×8½×7½ft.); No. 5, Duck house (16×10ft.). Price 3d. each, post free 4d. Set of 5 plans 1s. 3d., post free 1s. 6d.

Table Poultry Production.—The bulk of the cockerels reared are fattened on Sussex lines (the remainder being sold for stock purposes), and serve for the instruction of students in methods of killing, plucking and dressing.

Ducks and Geese.—A flock of White Runner ducks was added to the station last year, the birds reared on the rearing section, and at two months old transferred to a large ornamental lake in the gardens of the School of Agriculture. It might here be remarked that, while the natural conditions thus provided permit of ducks being reared cheaply—for they pick up a good deal of their living from the lake and adjoining shrubberies—it is, in our opinion, open to question whether the system is as satisfactory for purposes of egg production as more intensive methods. With so much natural food in the vicinity it is difficult to get the birds to eat as freely as could be wished of artificial rations provided for them, and a certain amount of difficulty in collecting eggs of birds at free range has always to be reckoned with.

A small flock of Canadian geese, also accommodated on the lake, forms an attractive feature of the department's stock.

Cost Accounting.—The question of cost accounting presents difficulties, due in part to the complexity of the station and in part to the necessity of entrusting students with the care of stock. The only possible way out of this difficulty would appear to be that of limiting enquiry to one section at a time, and for the present year we are restricting cost calculations to the large laying flock.

Courses of Instruction.—For the reasons indicated at the beginning of this article, it has been thought advisable to conduct, in addition to classes for students attending the general courses at the School of Agriculture, special short courses in poultry-keeping only. Two such courses commencing in January and April respectively, are now provided.

Co-ordination with County Work.—It may be of interest in conclusion to indicate the part which the poultry station plays in connection with the outside work of the School of Agriculture. One of the writers undertakes the whole of the peripatetic work in poultry-keeping in this county, and probably the greatest advantage which the county work as such derives from the poultry station lies in the intimate touch with practical affairs which the direction of the latter department enables him to maintain. It is of the greatest possible value in all county work to be personally concerned in the practical affairs of one's subject. By scarcely any other means can intimacy with markets and the ever-changing needs of the flock be maintained. Evening lectures and advisory work constitute the major part of the peripatetic work in this county. In the former department by far the most striking fact is the increasing number of people who manifest interest in the subject. Ten years ago audiences of fifteen to twenty could be reckoned good. To-day the average is over fifty.

Many casual factors influence the size of audiences at evening lectures, and it is difficult to argue with any confidence from the attendances at a few meetings. The averages for whole seasons, however, possess a fair degree of reliability, and judging by such averages in this county it would seem that urban and semi-urban areas led the way in the development of interest in the subject after the War, but that the rural districts are now ahead in this matter. In view of the relatively sparse population in the rural areas, the attendances in such areas are particularly striking.

It is further noteworthy that movements for the formation of poultry societies, formerly most noticeable in urban districts, are now making considerable headway in the rural areas also—though whether the educationist is to regard such movements as cause or effect it is difficult to say.

Advisory work is naturally of a very varied nature and only two features call for special mention. Noteworthy in the first place is the increasing number of poultry-keepers who ask for advice on and assistance in grading of stock. It is plain that selection of breeding stock is generally receiving more attention than heretofore. A second feature of note is applications for "hospital treatment" of special birds. We have had so many requests for such advice that the provision of a hospital section in the department has been considered. There are, however, difficulties almost needless to describe. Foods and feeding are of course a perennial source of inquiry.

HOARY PEPPERWORT OR THANET WEED.

G. H. GARRAD, N.D.A.,
Agricultural Organiser for Kent.

THE weed (*Lepidium Draba*, L.) which is known in Essex and Kent under the names of Whitlow Pepperwort, White Weed, Chalk Weed, Thanet Weed, Devil's Cabbage, Hoary Pepperwort, or Hoary Cress, has been described and illustrated in an article written by Mr. R. Robson which appeared in this *Journal* in April, 1919. It is a weed that has done an enormous amount of damage in Thanet and in North Kent during the past few years, and as it is gradually spreading from East Kent and from East Essex westwards, farmers should be on the look out for it so that they may be able to deal with it directly it appears on the farm before it has established itself.

This weed is a perennial, with creeping roots resembling those of bindweed. When it first appears on a farm as an isolated patch it is possible to deal with it by forking it out by hand. Once it has established itself over a large area, however, it is one of the most difficult of weeds to deal with because it spreads very rapidly by means of its underground roots, as well as by seed, and the roots run so deep down in the ground that it is impossible to reach them all with a plough. It flowers from May to June.

In this *Journal* for April, 1919, Mr. Robson related his endeavours to control this weed by spraying with copper sulphate. The results of his efforts in 1918 were encouraging, and his work was made the starting point of further spraying trials in Kent which will now be described.

Trials in 1921.—The first trials were made in 1921 on a field of wheat, badly infested with the weed, belonging to Mr. G. Reeves, Chestfield Manor Farm, Whitstable. On 22nd April two plots, each one-tenth of an acre in extent, were sprayed with copper sulphate as follows:—

Plot 1. At the rate of 14 lb. of copper sulphate and 56 lb. nitrate of soda dissolved in 70 gal. of water, per acre.
Plot 2. Unsprayed.
Plot 3. At the rate of 32 lb. of copper sulphate dissolved in 80 gal. of water, per acre.

The day on which the spraying was done was fine and dry, but two wet days followed. Nevertheless, when the plots were inspected a week later, it was found that although the wheat was slightly burned the results were eminently successful, the weed on both sprayed plots being very much browned and scorched. It was originally intended to spray one-half of each plot a second time, and they were visited on 13th May for this purpose but it was found that there was practically no live weed to spray. The wheat had completely recovered whilst the weed had become considerably more shrivelled and brown, especially on Plot 3. It was noticed, however, that close to the ground a few fresh shoots were springing from the old stems below the ground. The wheat by this time was 20 in. high whilst these new shoots were not more than an inch above the ground, so it was impossible to deal with them. The field was cut on 21st July, and an inspection on that day showed a marked difference between the two sprayed plots and the unsprayed plot. The crop on the unsprayed plot was thinner and not so tall, the thick growth of the weed having suffocated the crop. The yield on the unsprayed plot was obviously much less than on the sprayed plots. On the remainder of the field the weed had been hand pulled by casual labourers from Whitstable at an estimated cost of £2 14s. per acre.

Trials in 1922.—The results of the 1921 trial were so encouraging that it was decided to carry out a large number of trials in 1922.

The first experiment was designed to try the effect of spraying when the weed was young. Mr. A. Montgomery, Nash Court, Margate, offered a field of winter barley, and twelve plots, each one-twentieth of an acre, were sprayed between 25th April and 2nd May, when both the weed and the winter barley were about 8 in. high. Copper sulphate alone was used in different strengths, and varying quantities of the spray were applied per acre. Copper sulphate was also tried as a dry spray. Sulphate of ammonia was experimented with in two different strengths, and mixtures of copper sulphate with nitrate of soda and of copper sulphate with sulphate of ammonia were tried. In all cases the results were unsatisfactory. This was partly owing to the fact that the weather was very showery so that much of the spray was washed off, but principally because the weed was too young. The leaves of the weed were killed but a fresh growth shot out from the terminal buds, and by the end of June this new growth had produced flowers and begun to seed. The result resembled what happens when thistles are cut too early in the season. A second spraying was attempted on one-half of each of five of the plots on 19th May, but this seriously damaged the winter barley crop, the loss being estimated at three sacks of corn per acre.

It is possible that winter barley is more liable to damage by spraying than other cereals, but in any case the early spraying was a failure. Nor does there seem much likelihood of dry spraying being successful. Rain fell for about five minutes at 8.30 a.m., three hours after the dry spraying was done, and this may have washed some of the powder off the leaves, but it was noticed at the time of spraying that the powder would not adhere satisfactorily to the weed.

Sets of four plots, each one-twentieth of an acre in extent, were now laid down on five different farms and sprayed on the following dates :—

Messrs. Piggot Bros., Elmwood Farm, Minster	22nd May.
Capt. Hatfeild, Hartsdown Farm, Margate.	23rd "
Mr. A. W. Miller, Monkton Road Farm, Birchington.	24th "
Mr. J. Sayer, Cheeseman's Farm, Minster.	26th "
Mr. R. S. Vinson, Walter's Hall Farm, Monkton.	27th "
Mr. J. Read, Hundred's Farm, Westgate.	29th "

In every case four plots were sprayed as follows (all per acre) :—

Plot 1. 32 lb. of copper sulphate in 80 gal. of water.
Plot 2. 2 cwt. of sulphate of ammonia in 60 gal. of water.
Plot 3. 14 lb. of copper sulphate and 56 lb. of nitrate of soda in 70 gal. of water.
Plot 4. 14 lb. of copper sulphate and 56 lb. of sulphate of ammonia in 70 gal. of water.

The weather was hot and dry at the time of spraying of all the plots, and no rain fell afterwards for at least a fortnight.

The most successful results were obtained on Messrs. Piggott's farm, where the crop was young lucerne sown the previous autumn. The weed was sprayed when in full flower. The young lucerne was not damaged, but the weed was effectively dealt with on all plots, especially on Plot 1. The weed was so thick, however, that the quantity of spray used proved to be insufficient to reach every plant.

On the other four farms the crop was wheat, about 12 in. high at the time of spraying. The chalk weed was about the same height and in flower. Where the crop was thick so that it sheltered the weed the effect of the spraying was disappointing, and the best results were obtained where the corn crop was thin. There was little to choose between the efficacy of the different sprays used, but in most cases the mixture of copper sulphate and nitrate of soda was the least efficacious.

On 30th May a field of spring oats was offered for experimental purposes by Mr. G. Reeves, Chestfield Manor, Whitstable.

Seven plots were set out, each one-fortieth of an acre in extent, and sprayed as follows (per acre) :—

Plot 1. 32 lb. of copper sulphate in 80 gal. of water.
,, 2. 32 ,, ,, 100 ,,
,, 3. 32 ,, ,, 60 ,,
,, 4. 40 ,, ,, 80 ,,
,, 5. 40 ,, ,, 100 ,,
,, 6. 24 ,, ,, 60 ,,
,, 7. 24 ,, ,, 80 ,,

The crop was 12 to 15 in. high at the time of spraying and the flowers of the weed were beginning to fall. Plots 6 and 7 were a failure, the amount of copper sulphate being evidently too small. The results on Plots 1, 2 and 3 were all very similar, fairly effective, but not so effective as on Plots 4 and 5. Plot 4 was slightly superior to Plot 5, which was one of the most effectively sprayed plots in the whole year's set of trials. The spring oats were not seriously damaged on any of the plots.

On 6th June further plots were set out and sprayed as follows (per acre) :—

Plot 8. 48 lb. of copper sulphate in 120 gal. of water.
,, 9. 3 cwt. of sulphate of ammonia in 90 gal. of water.
,, 10. 20 lb. of copper sulphate and 84 lb. of sulphate of ammonia in 105 gal. of water.
,, 11. 32 lb. of copper sulphate and 13 oz. of saponin (to act as a spreader) in 80 gal. of water.

Plot 9 seemed to be the most effective, Plots 8 and 10 being very similar to Plots 4 and 5. On Plots 9 and 10 the spring oats were rather badly scorched and some stray plants of wheat suffered even worse. The effect of saponin as a spreading agent needs further trial.

General Conclusions.—It must not be expected that a single year's spraying will kill the deep underground roots of this plant, but it will prevent the smothering of the corn crop and it will weaken the plant. No plant can live indefinitely without leaves. and if the spraying treatment is persisted in there is every hope that the weed will gradually become less troublesome. Further experiments will be carried out in 1923. As a result of the trials the following conclusions have been tentatively drawn :—

1. Spraying before the weed is fully grown seems ineffective. The leaves of the plants are killed but the stems throw out a fresh growth. The most effective time to spray seems to be when the plant is in flower.

2. The following sprays are all fairly effective in destroying the leaves and stems if used when the plants are in flower :—

(*a*) 40 lb. of copper sulphate in 80 gal. of water.
(*b*) 2 cwt. of sulphate of ammonia in 60 gal. of water.
(*c*) 14 lb. of copper sulphate and 56 lb. of sulphate of ammonia in 70 gal. of water.

3. There is evidence to show that the plants should be hit with some force.

4. The spraying seems to be more effective if it is done on a dull dry sunless day rather than on a hot sunny day.

5. The spraying is most effective where the weed stands up well above the corn in which it is growing. If the corn is strong and protecting the weed, spraying is decidedly less effective.

6. Dry spraying has not proved effective.

7. Twice spraying damages the winter barley crop.

8. The spraying does not damage young lucerne.

9. The various sprays used have had no effect on bindweed or nettles, and very little effect on poppies or thistles.

10. The sulphate of ammonia spray shows its results very quickly and causes the leaves to turn a distinct light brown colour. It kills plants very thoroughly where they get a full dose. Sulphate of ammonia will also exert a manurial effect on the crop after rain has fallen.

11. Copper sulphate takes about a fortnight to show its full effect. It causes the leaves to turn a dirty green colour, which does not catch the eye so much as the effect obtained with sulphate of ammonia, but the leaves become quite brittle and then fall off the stems.

Note.—The spraying was carried out by Mr. T. W. Mc. D. Porter and acknowledgments are due to him, to Mr. W. M. Ware, Assistant Botanist at Wye College, who has taken much interest in the trials, and to all the farmers who gave the facilities for carrying out the experiments.

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HORTICULTURE IN THE ISLES OF SCILLY.

B. L. WOLF and A. D. R. WALBANK.

SOME forty miles distant from Penzance, along the wet highway that stretches from the Cornish Harbour to the Port of St. Mary's, lie what we may term the lovely Gardens of the Atlantic—the Isles of Scilly. Five islands of this group of some fifty rocky prominences are peopled with a sturdy race of industrious workers.

Although but tiny specks on the map of the world, St. Mary's, Tresco, St. Martin's, St. Agnes and Bryher, each is a veritable hive of industry of such a character that a brief outline of the inhabitants' activities may be of interest.

St. Mary's, the main island of the Scillies, is about nine miles in circumference, and has a population of about 1,200. The soil is typical of that to be found on the other inhabited islands in the group—a light sandy loam, varying in depth from a few inches to just over three feet. The average rainfall is approximately 30 in. per annum; the winter temperature averages 47 degrees Fahrenheit, the summer around ten degrees higher. The nature of the soil and climatic conditions are such that growth is hardly ever checked, even in the depth of winter. Owing to the smallness of some of the holdings, the cultivation of the soil alone will not suffice for the occupier to support his family; in these cases fishing is an added occupation.

The main industry in the Scilly Islands is flower production. Early potatoes form an important side line, and bulbs are also exported. The approximate tonnage of flowers and potatoes taken from the Islands to the mainland in the Scillies' own steamer, indicates the relative importance of these two crops. In 1922 some 790 tons of flowers were exported (in 1921 about 1,000) and just over 600 tons of early potatoes. The former amount represents, say, four and three-quarter million bunches! The bulk of these are narcissi—the well-known Soleil d'Or, Gloriosa, Poeticus ornatus, Scilly White, and Grand Primo, with Golden Spur, Princeps, and other trumpets that find favour in our markets.

Flower Growing.—The more sheltered parts of the islands are devoted to the cultivation of flowers, and even on some of the exposed parts an attempt is being made to grow them. Flowers seem to meet the eye at every turn. In the windows of the cottages, in tiny parcels of land tucked away in some out-of-the-way corner where one would not expect a flower could grow, in the meadows, the cultivated fields—flowers! Arum lilies, grown in the open, stocks, wallflowers, anemones, violets and narcissi—all these are cultivated—but the narcissus holds the front rank in the export trade and in the hearts of the horticulturists of the Scillies.

Wind is the bane of the narcissus cultivator. For this reason many of the fields are split up into a number of tiny patches by means of live hedges, formed of such shrubs as Euonymus, Veronica and Escallonia, which flourish in the islands; or wind breaks may be provided by the more modern method of combined wood and rush shelters. In addition to the favourite popular varieties referred to, some of the more recent introductions are being tried, including E. M. Berkeley and Harold. It is said that no bulb of the varieties Scilly White and Soleil d'Or has ever been imported into the islands. The flower industry has grown up from the humble beginning made with a few bulbs of these two sorts which were dug out from the hedgerows and given congenial accommodation in a sheltered garden.

The size of the holdings varies from 3 to 4 acres up to the rare figure of 60 acres. On well cultivated farms it is customary to allow the bulbs to remain for three years; they are then lifted, sorted into sizes and replanted in fresh fields. In others bulbs remain in the same beds for a number of years—and need it be added, some of the soils seem sick of providing a house for them? The subsequent treatment of the land is referred to in connection with the early potato industry. The early flowers are picked when the buds are breaking and taken inside to open. They are then put in bunches and marketed in non-returnable boxes made by the growers themselves. On an average 30 bunches are packed in each box, but, unfortunately, there are often far too many blooms crowded into the boxes in which they have to travel to Covent Garden and the large provincial markets of England and Wales.

Glass houses used to be more generally used for forcing than is the case now, but a few of the growers are renovating or rebuilding their glass houses. The largest area under glass is at Tresco, where over 50,000 sq. ft. of glass are in constant service. Flowers, potatoes followed by tomatoes, with mint as a catch crop, is the order of the cropping each year in these houses.

Bulb Exports.—Although something like 180 tons of bulbs were exported from the islands during the year 1922, bulb production for export has not yet been engaged in to any extent. That wonderfully good bulbs are grown here none will gainsay; their presence points to great possibilities if this branch of the narcissus industry can be developed. With limited space at disposal, however, some difficulty has been experienced by the smaller growers in obtaining for planting land which has not recently carried a crop of narcissi. The result is that bulbs occupy so much of the available area that there is insufficient break to ensure the elimination of the variety lifted before another sort goes in. Purity of stocks can then only be attained by resort to rogueing. There are other factors to be considered, but it cannot be too strongly emphasised that purity of stocks must be maintained if a successful trade in bulbs is to be achieved. It would appear that for the satisfactory development of this branch of the narcissus industry, a systematic rotation of crops is essential. There is need for more land, but there is very little more to be had

From the nature of the soil and the climatic conditions obtaining, it would seem that flowers other than the narcissus might offer a solution of the problem. It is highly probable that there are remunerative lines which might be taken up whilst the soil is resting from the daffodil. The facts could be ascertained by the establishment of trials on the islands themselves.

Early Potato Growing.—Although looked upon as a side line, the importance of this crop may be noted by the figure of 600 tons given as the approximate total of early potatoes exported during the year 1922. Before 1922 the crop was out of favour for some seasons, but it is now receiving more attention. A comparison of narcissus and early potato production is interesting; an islander has given it in his own words:—"A bad crop of flowers is better than a good crop of potatoes." This may be so, but it depends upon the farm on which the potatoes are grown. Opinion is divided as to the wisdom of further increasing the area, and in all probability this is due to wide variations in the degree of suitability of the sites available for the purpose on different farms. Where the crop can be lifted and marketed by mid-April a good price is usually secured. On the other hand, some of the growers cannot lift before the second week in May.

Dargill Early, under the name of Advance, is the prime favourite—in fact it is practically the only first early grown. Fresh seed is imported each year from Lincolnshire. In many cases earlies are only grown for the purpose of giving the land a rest from the bulbs, "without losing very much money by doing so," it is said. The preparation of the soil includes a very heavy dressing of seaweed, drawn from the beach and spread straightway over the surface and ploughed in. The tubers are boxed and sprouted before planting. The usual distance apart is 10 in. by 10 in. The practice on St. Mary's is to plant on New Year's Day, but there are exceptions to this date in some parts of the island. Many in St. Martin's and Tresco plant just before Christmas. The early potatoes are followed by a root crop, such as mangolds, swedes or carrots. A few growers in the second year follow the potatoes with a straw crop, a mixture of grass seeds being sown with it, and the seeds are allowed to remain for the third year, after which the land is broken up and prepared for bulbs.

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MONTHLY NOTES ON FEEDING STUFFS.

E. T. Halnan, M.A., Dip. Agric. (Cantab.),
Ministry of Agriculture and Fisheries.

The Agricultural Organiser for Northamptonshire, Mr. W. A. Stewart, has recently tried several feeding stuffs not in common use. The results of his observations are sufficiently interesting to merit notice here, and are as follows:—

Chocolate Meal.—With care this material can be used safely with all classes of cattle and pigs. It may be decidedly harmful if used in excess. Up to 1 lb. per head for adult cattle and up to ½ lb. per head per day for young stock may be given. It is useful as an appetiser when fed with inferior hay and straw or chaff. With regard to pigs, up to 10 per cent. of the ration may be used with good results, but it is not suitable for admixture with fish meal.

Dried Yeast.—Dried yeast can be used up to ½ lb. per gallon of milk for cows, and 1 lb. per head per day for young stock. It has a slightly bitter taste, and a little difficulty may be experienced at first in getting the stock to eat it. Dried yeast should not be mixed in a ration containing sugary material such as treacle or chocolate meal.

Mineral Requirements of Dairy Cows.—The work of Forbes and others has called attention to the fact that under normal agricultural conditions a heavily milking cow often shows a negative balance for both calcium and phosphorus, but particularly calcium. That is to say, more calcium and phosphorus leave the body in the form of excreta and milk than are supplied in the ration. It has been shown that this condition of negative balance is more likely to occur when the forage is fed in a cured state, *i.e.*, in the form of hay. In the case of dry cows, Forbes'

DESCRIPTION.	Price per Qr.		Price per			Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.								
	s.	lb.	s.	£	s.	£	s.	£	s.		s.	d.
Wheat, British - -	44/6	504	9/11	9	18	0	18	9	0	71·6	2/6	1·34
Barley, British Feeding	28/0	400	7/10	7	17	0	14	7	3	71	2/–	1·07
„ Danubian „	31/–	„	8/8	8	13	0	14	7	19	71	2/3	1·20
„ Persian „	27/–	„	7/7	7	12	0	14	6	18	71	1/11	1·03
Oats, English White -	30/0	336	10/–	10	0	0	16	9	4	59·5	3/1	1·65
„ „ Black & Grey	28/0	„	9/4	9	7	0	16	8	11	59·5	2/10	1·52
„ Scotch White -	36/–	„	12/–	12	0	0	16	11	4	59·5	3/9	2·01
„ Canadian No. 2 Western	30/6	320	10/8	10	13	0	16	9	17	59·5	3/4	1·78
„ „ No. 3 „	28/9	„	10/1	10	2	0	16	9	6	59·5	3/2	1·70
„ „ Feed -	27/3	„	9/6	9	10	0	16	8	14	59·5	2/11	1·56
„ American - -	26/3	„	9/2	9	3	0	16	8	7	59·5	2/10	1·52
„ Argentine - -	26/3	„	9/2	9	3	0	16	8	7	59·5	2/10	1·52
Maize, Argentine - -	40/–	480	9/4	9	7	0	15	8	12	81	2/1	1·12
„ American - -	38/6	„	9/–	9	0	0	15	8	5	81	2/–	1·07
Beans, English Winter -	46/6	532	9/9	9	15	1	18	7	17	67	2/4	1·25
„ Rangoon - -	—	—	8/11	8	18	1	18	7	0	67	2/1	1·12
Peas, English, Dun -	58/–	504	12/11	12	18	1	13	11	5	69	3/3	1·74
Millers' offals—												
Bran, British - -	—	—	—	7	2	1	11	5	11	45	2/6	1·34
„ Broad - -	—	—	—	8	5	1	11	6	14	45	3/–	1·61
Fine middlings (Imported) - -	—	—	—	9	0	1	6	7	14	72	2/2	1·16
Coarse middlings (British) - -	—	—	—	7	5	1	6	5	19	64	1/10	0·98
Pollards (Imported)	—	—	—	6	7	1	11	4	16	60	1/7	0·85
Barley Meal - - -	—	—	—	9	12	0	14	8	18	71	2/3	1·34
Maize „ - - -	—	—	—	10	5	0	15	9	10	81	2/4	1·25
„ Germ Meal - -	—	—	—	9	0	1	2	7	18	85·3	1/10	1·98
„ Gluten-feed -	—	—	—	9	0	1	12	7	8	75·6	1/11	1·03
Locust Bean Meal -	—	—	—	8	0	0	11	7	9	71·4	2/1	1·12
Bean Meal - - -	—	—	—	12	5	1	18	10	7	67	3/1	1·65
Fish „ - - -	—	—	—	17	2	5	0	12	2	53	4/7	2·45
Linseed - - -	—	—	—	21	0	1	16	19	4	119	3/3	1·74
„ Cake, English (9°/o oil)	—	—	—	12	0	2	5	9	15	74	2/8	1·43
Cottonseed Cake, English (Egyptian Seed) (5½°/o oil)	—	—	—	7	10	2	0	5	10	42	2/7	1·38
„ „ Egyptian (5½°/o oil)	—	—	—	7	6	2	0	5	6	42	2/6	1·34
Coconut Cake (6°/o oil)	—	—	—	8	5	1	15	6	10	73	1/9	0·94
Palm Kernel Cake (6 °/o oil)	—	—	—	7	0*	1	7	5	13	75	1/6	0·80
„ „ Meal (2°/o „)	—	—	—	5	10	1	8	4	2	71·3	1/2	0·62
Feeding Treacle - -	—	—	—	4	0	0	9	3	11	51	1/5	0·76
Brewers' grains, dried, ale	—	—	—	7	17	1	8	6	9	49	2/8	1·43
„ „ „ porter	—	—	—	7	10	1	8	6	2	49	2/6	1·34
„ „ wet, ale	—	—	—	1	13	0	11	1	2	15	1/6	0·80
„ „ wet, porter	—	—	—	1	9	0	11	0	18	15	1/2	0·62

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 6d.; P_2O_5, 4s. 6d.; K_2O, 2s. 10d.

results showed that the rations fed usually supplied more calcium and phosphorus than were required, and the excess was stored in the body. As far as the scientific side is concerned, our knowledge on the subject is still incomplete, but sufficient is known to indicate the steps that farmers should take to supply the mineral requirements of milking cows, particularly during the winter period when fresh grass is not available.

Generally speaking, the phosphorus needs of the cow are supplied in an ordinary mixed ration in American practice, but the calcium needs were rarely supplied when a large quantity of lucerne hay was supplied in the ration. In English practice, the best method of supplying this deficiency is to include legume hay, such as clover hay, lucerne and sainfoin hay, or pea and oat hay, in the roughage fed during the winter period.

Use of Milk for Calves.—In an experiment carried out by Andrew C. McCandlish at Iowa, an attempt was made to raise two bull calves on a diet consisting wholly of milk. The results are of practical interest in that they emphasise the fact that milk is only an ideal food for young stock for a limited period. In the experiment in question, no roughage, water or grain was given to the experimental animals, which grew satisfactorily until two or three months old. From this period onward they did not thrive, and eventually death occurred. The author suggests that the lack of bulk of the ration, the possible deficiency of water-soluble B and C vitamines, and excessive consumption of salt, may have been the contributory causes leading to the emaciation and subsequent death of the calves

FARM VALUES.

CROPS	Value per Ton on Farm.		Manurial Value per Ton		Food Value per Ton		Starch Equivalent per 100 lb	Value per unit S E	Market Value per lb S E.
	£	s	£	s	£	s		s d	d
Wheat - - - - - -	8	1	0	18	7	3	71·6	2/0	1·07
Oats - - - - - -	6	15	0	16	5	19	59·5	2/0	1·07
Barley - - - - - -	7	16	0	14	7	2	71·0	2/0	1·07
Potatoes - - - - -	2	0	0	4	1	16	18·0	2/0	1·07
Swedes - - - - -	0	17	0	3	0	14	7·0	2/0	1·07
Mangolds - - - - -	0	15	0	3	0	12	6·0	2/0	1·07
Good Meadow Hay - -	4	19	0	16	4	3	31·0	2/8	1·43
Good Oat Straw - - -	2	13	0	8	2	5	17·0	2/8	1·43
Good Clover Hay - -	5	9	1	4	4	5	32·0	2/8	1·43
Vetch and Oat Silage - -	2	1	0	8	1	13	14·0	2/4	1·25

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending April 11th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	14. 0	14. 5	13. 10	13. 2	16.11
„ „ Lime (N. 13 per cent.)	...	...	...	12. 7	19. 0
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
„ „ „ neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.)	...	..	...	2. 0	3. 2
„ (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.)	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.15	8. 0	8. 0	3. 2
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11.15	4.11
Basic Slag (T.P. 30-32 per cent.)	3.12§	...	...	3.15§	2. 5
„ „ (T.P. 26 per cent.)	...	2.12§	...	...	...
„ „ (T.P. 24 per cent.)	...	2. 8§	2. 7§	...	...
„ „ (T.P. 20-22 per cent.)	2.10§	2. 5§	...	2.12§	2. 6
„ „ (T.P. 16-18 per cent.)	2. 0§	...	2. 0§	2. 8§	2.10
Slag Phosphate (T.P. 60 per cent.) ...	6. 7†	...	..	6.15§	2. 3
„ „ (T.P. 50 per cent.) ...	...	...	...	5.15§	2. 4
„ „ (T.P. 40 per cent.) ...	4. 7†	...	...	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	4. 0	2. 3
„ (S.P. 30 per cent.) ...	3.17	3. 7	3.15§	3.12	2. 5
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 5	8.12	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7.10†	7. 0	6.17	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13. 7	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works. ‡ At Goole.

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Test of Second Growth Potatoes for Seed.

THE following note has been communicated by Professor R. G. White and Mr. E. J. Roberts, of the Department of Agriculture, University College of North Wales, Bangor:—

In 1921 second growth occurred to a great extent among potatoes, particularly those varieties possessing a vigorous type of growth, Kerr's Pink being one of the kinds mostly affected. Many experienced growers expressed doubt as to whether the tubers which had grown out would be of value for seed, but from many quarters recommendations were made advising the selection of the secondary tubers for seed purposes. The opinion was generally held that such tubers would be more or less immature and of special value for the purpose.

In order to test this point a plot of Kerr's Pink at the farm of the University College of North Wales at Aber, in which second growth had occurred to a great extent, was carefully lifted by hand, and pairs of tubers, first and second growth respectively, were selected for seed purposes. Only those tubers were taken in which the connection remained unbroken, so that each second growth tuber planted in 1922 in the one plot had its counterpart in the plot planted with first growth tubers. In order to test how far any difference obtained was due to immaturity of seed two such double lots of seed were lifted, the first on 26th September, when the crop was still quite green and growing vigorously; the second on 29th October, when the tops had died down, and the crop was judged to be ripe for lifting. Sufficient seed of each kind was taken to plant in 1922 a plot of one-thirtieth acre. All the seed was boxed immediately after lifting and planted on 11th April, 1922.

The results obtained in 1922 are given in the following table:—

Date of lifting seed potatoes	Nature of tubers	Weight of crop per acre 1922			
		Marketable	Small	Diseased	Total
		t. cwt. lb	t. cwt. lb	t. cwt. lb.	t. cwt. lb.
26th September, 1921 ...	1st growth	9 19 28	0 17 28	0 3 84	11 0 28
do. ...	2nd growth	10 0 28	0 16 0	0 2 84	10 19 0
29th October, 1921 ...	1st growth	10 0 0	0 19 56	0 2 84	11 2 28
do. ..	2nd growth	8 7 56	1 4 84	0 2 28	9 14 56

It is clear that the first growth tubers were in no way inferior as seed to the second growth tubers. The two lots of seed lifted on 26th September gave the same result. In the case of the seed lifted at the end of October the second growth tubers gave an inferior result.

These results are very different from what was expected, but the experiment was conducted with such care that we have every confidence in publishing them, and as it is only rarely that second growth occurs to such an extent as to enable the experiment to be repeated, they are now given in the hope that the matter will be further investigated elsewhere when possible.

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Variety of Potato immune from Wart Disease.

IN the report on the Wart Disease Immunity Trials carried out at Ormskirk in 1922 (see this *Journal*, March, 1923), it was stated that in addition to the varieties mentioned therein, the Ministry was prepared to add certain seedlings to the official list of approved immune varieties when they had been named.

One of these seedlings has now been named "Norna," and it has accordingly been added to the official list. The following is a description of this variety :—

Late or Maincrop Variety.

(1) *Sprout.*—Bright red.

(2) *Tuber.*—Oval ; skin white ; flesh white ; eyes shallow.

(3) *Haulm.*—Upright to spreading, somewhat straggling ; leaflets light green, small corrugated, glossy, drooping, involute ; leaf open.

(4) *Flowers.*—None observed.

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Clean Milk Competitions.

"CLEAN MILK" is now regarded as a national necessity and dirty milk as a national menace. The difference between clean milk and dirty milk is the difference between carefulness and carelessness on the part of those concerned—producer, cowman, and retailer. Milk has long been recognised as a valuable food in the home—the best possible food for the young—but the importance of securing milk of a clean, safe, and wholesome quality has not yet received the attention which it so emphatically deserves. In this connection it should be noted that actual results have proved that milk of high hygienic and good keeping quality can be produced in the average cowshed at very little additional cost, provided careful methods be adopted. Increasing attention is being given to this subject by certain Local Agricultural Education Authorities, and notes have appeared from time to time in this *Journal* giving particulars of clean milk competitions organised by such Authorities and by firms engaged in the milk trade.

There is at present a Clean Milk Competition in progress in Essex, and a similar competition held in Kent terminated in the middle of April.

Essex Competition.—The Essex competition, which started on 1st February and will continue until the 30th June next, has, as in previous years, been organised by the Essex Agricultural Society with the co-operation of the East Anglian Institute of Agriculture. The following are the conditions of this year's competition in Essex.

The competition is open to county residents and occupiers. Surprise samples (not exceeding 6 in number) are taken at the farms. Competitors must also send 6 samples taken from a full churn of milk immediately after cooling on stated days. The churns and other utensils are examined for bacterial contamination.

Herds are inspected by a veterinary surgeon once during the competition and a certificate is awarded. The veterinary surgeon's report is sent direct to the judges at the East Anglian Institute of Agriculture, Chelmsford.

Class A. Tuberculin Tested Herds.—Ten or more cows in milk. A diploma is awarded to each competitor who, in the opinion of the judges, produces milk of a sufficiently high hygienic quality. £5, £4, £3, £2 and £1 are given in prizes, together with a certificate to the milkers. Second prize will be awarded if three or more entries, and the third prize if five or more entries.

Marks—1,600.

Tuberculin Test...	100
Health of Cows ...	100
Equipment	100
Methods...	400
Bacterial Content	800
Chemical Analysis	100
	1,600

Class B. Dairy Herd.—Ten or more cows in milk. To the winner, Challenge Cup (given by Captain Allan Skelton), and diploma. (The cup is to be won two years in succession or three years in all to become the actual property of the winner). A diploma is awarded to each competitor who, in the opinion of the judges, produces milk of a sufficiently high hygienic quality. £5, £4, £3, £2, and £1 are given in prizes, together with a certificate to milkers. The second prize will be awarded if there are three or more entries, and the third prize if five or more entries. 1,500 marks are given as in Class A., less 100 for the tuberculin test.

Herds obtaining a diploma, and at the same time having a herd that has passed the tuberculin test, are awarded a certificate to that effect, in addition to the diploma.

Champion Prize.—Howard Challenge Cup (given by H. G. Howard, Esq.). The Howard Challenge Cup is awarded to the competitor taking the highest number of marks in Class A. or B. The marks for the tuberculin test do not count for this award. The cup is to be won three years in succession before becoming the actual property of the winner.

Kent Competition.—The Kent competition attracted 58 entries, a testimony to the keen interest aroused amongst dairy farmers in the county. Fortnightly tests of competing herds were made and surprise inspections of methods and appliances used at milking were carried out. It is especially gratifying to learn of the keenness displayed by the farm hands, but the whole progress of the competition must be a great encouragement and a matter for congratulation to all concerned. At the time of writing the full results of this competition had not come to hand.

It is hoped that similar competitions will be followed in other counties, as these local competitions are very effective in arousing interest in the subject, even among non-competing milk producers.

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Seed Testing in Northern Ireland.

THE Government of Northern Ireland has established an Official Seed Testing Station at Belfast for the purpose of testing the germination and purity of the principal classes of cereal, grass, clover, root and vegetable seeds, in accordance with the provisions of the Seeds Act, 1920. Enquiries as to the procedure for sending samples, the fees payable and other relative matters, should be addressed to the Secretary, Ministry of Agriculture for Northern Ireland, Wellington Place, Belfast.

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Prosecution for False Application of the Trade Description "Sussex Ground Oats."

PROCEEDINGS under the Merchandise Marks Act, 1887, were recently instituted at Oldham by the Ministry of Agriculture against a firm of millers who had applied the description "Sussex Ground Oats" to an article which contained 70 per cent. of material not derived from oats. The case originated in the North Riding of Yorkshire where an official sampler took a sample of Sussex Ground Oats under the Fertilisers and Feeding Stuffs Act, which was found to be adulterated. It was considered by the Local Authority that the local trader was not to blame, and they therefore arranged with the Ministry that the consignment should be traced to its source and that the original seller should be prosecuted under the Merchandise Marks Act. The consignment was traced through the hands of merchants at Stockton, Leeds and Liverpool, and finally to the manufacturers at Oldham. The defendant pleaded guilty, but urged in mitigation that it was customary to sell mixtures as "Sussex Ground Oats," and that they had sold them with the usual notice on the invoice that the article was the product of more than one substance or seed. The magistrates, however, took a serious view of the case and inflicted a fine of £10 and £20 costs.

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Importation of Potatoes into Jersey.

GROWERS and exporters of potatoes are informed that, following representations made to the Jersey Authorities by the Ministry, the regulations governing the importation of potatoes into Jersey from Great Britain and Ireland have now been modified. In future, potatoes may be imported into Jersey if grown more than one mile from land known to be infected with wart disease; previously, all potatoes grown within five miles of infected land were prohibited entry.

It will still be necessary for each consignment to be accompanied by a sworn declaration by the exporter that wart disease has not occurred on the land where the potatoes were grown, as well as by an official certificate that the disease has not occurred within one mile of such land. In the case of potatoes grown in England and Wales, applications for the necessary certificates should be sent to the Ministry, together with a remittance at the rate of 1s. for each certificate required.

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Results of the November Rat Week.

REPORTS are now available as to the National Rat Week held early in November last, in which the Ministry of Agriculture invited the co-operation of all Local Authorities and the general public. Five hundred and eight Local Authorities were circularised, and a large number of them took special action as requested. Other Local Authorities were known to be giving the business of rat destruction such constant attention that there was little left for them to do in Rat Week. Several Local Authorities prepared or purchased the rat poisons recommended by the Ministry, and in 17 instances issued them free of charge, and in 6 sold them at cost price. One Local Authority purchased a number of steel traps which it lent out to applicants.

In many districts Local Authorities invoked the aid of cinema proprietors, who willingly assisted in the showing of films and slides dealing with the rat menace and rat destruction. The Town Council of Leeds organised an exhibition in the Public Health Office, at which the various media for rat destruction were placed on view and literature on the subject was distributed. In some districts the co-operation of local chemists and hardware merchants was sought, and these salesmen induced to give special window displays of poisons, traps, etc.; this method was found to supply an excellent local advertisement for the Rat Week.

Perhaps the most useful part of the work done by Local Authorities, however, was through the example set by them in clearing the large sources of infestation in the property under their care, *e.g.*, in the sewers, rubbish shoots, sewage farms. Householders, knowing of the determined attack which the Local Authorities were making in this direction, saw the usefulness of making a similar effort at the same time on their own piece of " front " against the common enemy. In 28 districts, reports show that Sanitary Inspectors made house-to-house visits and cleared the rats from infested premises as they went; in some of these " gassing " was adopted, usually with excellent results.

In regard to numbers of rats destroyed, no general statistics are available, and very few Authorities have tried to give figures. One Local Authority (Stoke-on-Trent), however, kept as careful record as possible of the numbers of rats known to have been killed during the Week; these were—859 killed by dogs and ferrets, 385 poisoned, and 241 caught or killed in other ways; a total of 1,485.

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Worn-out Horse Traffic.*

The following reply has been directed by Sir Robert Sanders, M.P., Minister of Agriculture, to a letter from Miss A. M. F. Cole, of the Royal Society for the Prevention of Cruelty to Animals, regarding what has been described as the worn-out horse traffic, and to a letter from the same lady of 5th March, circulated to Members of Parliament and to the Press:—

" As you are aware, the export of worn-out horses to the Continent has entirely ceased, and the Minister notes that your criticism is now directed not against the standard of fitness of the horses shipped nor the manner in which they are conveyed to the Continent, but to the fact that a few of the horses exported are purchased by butchers on the Continent for slaughter. In reply to this the Minister desires me to say that he has no control over the horses after they leave this country. His powers under the Exportation of Horses Acts are limited to ensuring that the horses shipped are in a fit condition to travel and to work, and that the horses are conveyed to the Continent in a satisfactory manner. When it is the custom of a country eventually to slaughter its horses for food it is obviously impossible to ensure that horses exported to that country are not sooner or later slaughtered for that purpose, whatever their value or character may be at the time of exportation. To ensure, therefore, that no horses sent to the Continent are slaughtered for human food it would be necessary to stop the trade in working horses altogether, and this the Minister has no power to do, even if such a course were desirable.

In your letter of the 5th instant you refer to the landing of 95 English horses at Antwerp on 23rd October. Among these horses were a considerable number of sound young animals ranging from foals upwards, and including many ponies and cobs. The Ministry's Superintending Inspector was present with other inspectors at the landing of the whole of this consignment, and it is clear from the reports of these inspectors that they were a very fine lot of animals. You also refer to the fact that working horses are released on the quay with a working licence. This is no new procedure; a proportion of the horses landed from Great Britain have always been so released, but the fact that the proportion has largely increased in recent months proves that the animals shipped are of a much higher standard than formerly. As a matter of fact the standard required by the Minister's inspectors at the ports of embarkation is a good deal higher than that of many horses working in the streets of this country.

Notwithstanding this, a few of the animals may be purchased by butchers for slaughter. The number purchased for this purpose, however, has decreased considerably during the last eighteen months, and the traffic in horses for slaughter has been largely superseded by a traffic in carcasses of horses slaughtered in this country. For example, during January and February of 1921 the number of horses exported to Antwerp from Hull, Goole and Leith (the principal ports concerned) was 3,676. During the first two months of 1922 this number fell to 816, and during the corresponding period of this year the number was only 42. Many of these 42 were of the cob and riding class of good value, for which there is still a certain demand on the Continent, and they would not be bought for slaughter on arrival there. From the reports of the Ministry's Superintending Inspector, who pays frequent visits to the

Continent, it is clear that for some time past it has been generally unprofitable to purchase British horses for slaughter on arrival at Antwerp. This is due to the high standard of fitness required by the Ministry, the high cost of transport, and the competition of the trade in carcasses which has so largely increased during the past eighteen months.

In reply to your inquiry as to who declares the value of the horses exported, the Minister desires me to say that the values quoted by him in recent replies to Parliamentary questions are the ' declared values ' recorded in the Monthly Trade and Navigation Accounts published by the Board of Trade.

Reference is made in your letter to a recent visit to Rotterdam, where you saw certain British horses in the market. I am to point out that every horse from Great Britain appearing on the market at Rotterdam must, according to Dutch regulations, have passed through the quarantine station there, where feeding and watering is compulsory. The Ministry's Inspector has found from personal inquiry that practically all such horses appearing in the Rotterdam market have been released from quarantine the same morning. The fact that one of the horses eagerly accepted some lumps of snow does not prove that the animal was parched with thirst. An offer of snow to any other animal in the market would probably have had the same result. The walking of horses some miles to a place of slaughter does not necessarily involve cruelty to the animals. Working horses of the class passed at the ports of shipment are quite fit to walk to their places of destination, although this may be more than ten miles distant.

As regards the method of slaughter in Holland, it is necessary under Dutch regulations to slaughter all animals in public abattoirs, and the method of slaughtering horses is by pole-axe or humane killer, principally the latter.

The Minister has made inquiries into the death of the two horses in a cargo of twelve shipped on the s.s. ' Roman ' from Leith to Amsterdam on the 10th February. It appears that the weather remained good for about eight hours after the vessel had left Leith, and then suddenly changed, causing the vessel to labour heavily. One of the horses was taken suddenly ill and died without a struggle, the other got down in his stall and died some time later. The deaths were precipitated by sea sickness. The remaining ten horses were landed in good condition. The inspector who examined these animals before shipment states that they were all of a very good class. The two casualties were unfortunate, but there is, of course, an element of risk in shipping live horses across the open sea whatever precautions are taken. The same risk has to be taken in regard to all classes of animals shipped. Only recently a thoroughbred mare of the value of £200 died as a result of a broken leg on a voyage to Ireland. Other horses fell on the same voyage, but were able to get up again without injury.

As regards the export of horse carcasses, I am to say that the Belgian Authorities have recently called the attention of the Ministry to the need for improvement in the packing of the carcasses, and although the Minister has no power to regulate this matter the Department has made representations to the companies engaged in the trade. I may point out, however, that out of 88,000 quarters exported to Antwerp during the year 1922, only 339 quarters were condemned. In connection with this matter the Minister in 1921 formally invited the Belgian Government to appoint their own veterinary inspectors, if they thought fit, to examine in Great Britain the horses slaughtered on this side and the carcasses intended for export for human consumption. As an alternative the Ministry offered to nominate veterinary surgeons to carry out such examinations to satisfy Belgian requirements. The Belgian Government did not, however, avail themselves of the Ministry's offer.

In conclusion, the Minister desires me to assure you that he has every sympathy with all well-directed efforts to put an end to avoidable suffering to animals. So far as the transport of horses by sea is concerned, everything possible has been done by the Ministry to ensure the comfort of the animals. The Ministry's regulations prescribe a standard to which the fittings of the vessels must conform, they prohibit the carriage of horses on unprotected parts of vessels during the winter months, and they lay down definite rules for food and water and general comfort of the horses immediately before and during shipment."

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Ministry's Exhibits at Agricultural Shows.

DURING the show season of 1922, 12 of the most important agricultural and horticultural shows were visited with the Ministry's exhibit. The Ministry's stand attracted a large number of visitors, inquiries were numerous and varied, and leaflets and publications to the value of £188 were sold.

Exhibits were also loaned to a number of small shows on payment of the cost of rail carriage by the Societies concerned.

From the point of view of educational value the year's work was very satisfactory, and the Ministry's exhibit would seem to have been appreciated by a large number of people.

During the coming show season it is proposed to take an exhibit to the principal shows, including the Bath and West (to be held at Swansea from May 17-22); the Royal Counties (Southampton, May 30 to June 2); the Royal Agricultural Society of England (Newcastle-on-Tyne, July 3-7); the Lincolnshire (Lincoln, July 18-20); the Royal Welsh (Welshpool, July 25-27); the Royal Lancashire (Liverpool, August 2-6); the Imperial Fruit and National Potato Show (Manchester, October 26 to November 3); the Norwich Fat Stock Show (Norwich, November 22-24); and the Birmingham Fat Stock Show (Birmingham, December 1-6).

Special exhibits relative to clean milk production and showing the results of research in fruit-growing, soils and manures, plant breeding, and silage and silos are in course of preparation, in order to give publicity to recent developments in agricultural research. Other exhibits will deal with building, insect and fungus pests, rat destruction, seed testing, small live stock, bee-keeping, and other matters.

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A Tulip and Daffodil Farm in the Isle of Wight.

WITHIN easy access of the villages of Godshill and Sandford, in the Isle of Wight, on the elevated land overlooking the "Valley of Daffodils" where these flowers grow wild, an ex-Service officer is establishing a daffodil and tulip farm. At the present time some two acres of land have been put under cultivation. The land selected slopes gently to the west and there is a fair amount of natural shelter. The soil is a medium loam with a superficial covering of sand; the subsoil is clay. It is not the kind of soil one would have selected for the purpose, but the owner appears to be making a success out of his venture and is considering immediate extension of the cultivated area, by breaking up some of the adjoining land now under grass.

Apples have been planted in rows 18 ft. apart, the trees being 21 ft. apart in the rows.

Narcissi and tulips form the bulk of the flowers grown, but a few beds of wallflowers, which were planted for trial, have given such good financial results that it is probable more of these will be grown in future.

The flower beds are slightly raised above the level of the surrounding land and are cut out in blocks of sufficient size to accommodate about 2,000 plants, set out in rows running north to south, 8 in. apart with about 8 in. between the plants in the rows. There are generally three of the beds between each row of apple trees—2 ft. being allowed between the apple trees and the bed adjacent to them, and a 2-ft. path between each bed to facilitate picking.

The occupier, his wife and daughter do practically all the work on the "farm," the only outside help obtained being casual labour for flower picking. The little place is a model of cleanliness and good management.

The preparation of the land for bulbs is effected by taking a well-manured potato crop and constantly cultivating during the time the crop occupies the soil. The bulbs used to have a dressing of kainit after planting, but they do not now receive any manurial treatment at all. The narcissi are allowed to remain for upwards of five years; the tulips are lifted annually. The occupier tried leaving the tulips for two years, but finds the plants produce more flowers if lifted each year. He has not tried lifting his narcissi at three years, and it is probable that it would pay him to do so

The first picking of narcissi usually commences in the first week of February; tulips are gathered from the beginning of April.

Most of the well-known commercial varieties of narcissus and tulip are grown, notable exceptions in the former being Soleil d'Or and Scilly White. Irving and Golden Spur are the earliest kinds grown. In tulips, the Darwin types are specially favoured. The popular Clara Butt is perhaps the most profitable of all the tulips grown here.

Flowers have been the mainstay of the business, but it is the intention of the owner to sell bulbs when he has sufficient stocks for this purpose. There is a good local demand for the flowers; a large number of visitors on the way to or from the "Valley of Daffodils" purchase bunches of the cultivated sorts. A few lots are sent to the northern markets, but the bulk of the business is done on the spot.

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Young Farmers' Tour in Canada.

An account of the introduction of the Young Farmers' Club movement into this country and of the methods of organisation adopted in the early stages appeared in this *Journal* for March, 1922. Since that time considerable progress has been made. There are now 35 clubs in existence in England and Wales with a membership of over 600, and there is every likelihood of rapid extension in the future. The *Daily Mail* maintains its interest in the movement, and the possibilities of these clubs are being increasingly recognised by breed societies and by business firms dealing in agricultural products. The Ministry regards the movement as an important form of agricultural education, and assists it by any means in its power.

The *Daily Mail* International Federation of Young Farmers' Clubs is proving a valuable means of exchange and communication between boys' and girls' agricultural clubs in the United States, Canada and England. A great impetus has now been given to this work by the generosity of the Presidents of the Canadian National Railways and the Canadian Pacific Railway, who have made arrangements for four boys and four girls, chosen from Young Farmers' Clubs over here, to pay an educational visit to Canada this summer.

The boys who have been selected have just left England, and the girls will start shortly. They will be absent for 6 months. They will visit agricultural departments, experimental farms and boys' and girls' clubs in Quebec, Ontario, Alberta, Saskatchewan, Manitoba and British Columbia, and will also profit by summer courses at Canadian colleges. The arrangements made not only provide for care and instruction but for much individual entertainment. It is evident that such an experience will have very far-reaching effects, not only on the lives of the individuals concerned but also on the relationship between young farmers in England and Canada.

Suitable candidates for the trip were chosen, in the first instance, by the clubs of which they are members. The final selection was made by an examining body representative of the Board of Education, the Ministry of Agriculture and the National Farmers' Union. The successful candidates were:—

Boys.—L. J. Grimmer (Buckland Club), T. C. White (Kingsclere Club), G. W. Salter (Hemyock Club), J. Murray (Welwyn Garden City Club). *Girls.*—Joan Moore (Loughborough Club), Mildred White (Hemyock Club), Joy Townsend (Guildford Club), E. M. Absolon (Hornsey Club).

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Foot-and-Mouth Disease.—All restrictions imposed in connection with the outbreaks in Gloucestershire and Derbyshire have been withdrawn, as from 24th March and 5th April respectively.

On 3rd April a fresh outbreak of the disease occurred in Norfolk, three cattle-out of 13 being found to be affected on premises at Billockly, near Acle.

A calf from the premises had been exposed in Acle market on 29th March, but so far there have been no extensions of the disease. The usual restrictions were imposed on 3rd April, and have since been modified in the outer portions of the district affected. The area under restrictions has now been reduced to approximately a five mile radius from the infected premises.

Dogs from Ireland.—The case of illness in a cat at Newcastle, Co. Down, which was diagnosed as rabies in February last, has not been followed by the discovery of any cases of rabies in dogs or other susceptible animals in Ireland, notwithstanding searching inquiries by the authorities. The County Down (Muzzling and Control of Dogs) Order of 20th February, 1923, has in consequence been revoked, and the Ministry has in the circumstances felt justified in withdrawing the restrictions imposing quarantine on dogs imported into Great Britain from Ireland. An Order to this effect was made on 21st April, and as from that date no licence is required for the landing of dogs from Ireland.

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QUESTIONS IN PARLIAMENT.

The following question was answered in the House of Commons on the 11th April:—

Relief of Rural Unemployment.—*Mr. Turton* asked the Minister of Agriculture whether he is aware that a large amount of agricultural labour has failed to be absorbed on the land; and whether, to assist such unemployment, he is prepared to continue to aid schemes for land drainage and water supply throughout the year?

Sir R. Sanders replied that he proposed to recommend a resumption in the early autumn of schemes for the relief of rural unemployment, but during the summer months there is usually little or no unemployment among agricultural workers, and it would be undesirable to set on foot schemes which might endanger the supply of labour required during the harvest months.

Agricultural Workers.—In reply to a question by Mr. Noel Buxton on 22nd March, as to the number of boards of guardians which were granting relief in aid of the wages of agricultural labourers, Mr. Chamberlain said that cases of this kind had been reported by nine boards of guardians, but that, so far as he was aware, six of these boards had subsequently ceased to grant such relief.

On 26th March, Mr. Noel Buxton asked whether, having regard to the reduction in wages of farm labourers proposed by the Farmers' Union, and to the fact that farm labourers in employment had in numerous instances to seek relief from the Poor Law, the Minister of Agriculture would set up a Committtee of Inquiry on the question whether farmers on good land were justified by economic conditions in making the reductions. The Minister, in reply, said that he did not think that an inquiry of the kind suggested would be of service in the present circumstances, and pointed out that he had suggested to both sides in the Norfolk dispute that they should agree to accept the decision of an independent arbitrator appointed by the two sides jointly.

Rear-Admiral Sueter asked on 29th March whether the Prime Minister would consider the propriety of suspending the payment of subsidies for the emigration of agricultural workers until some attempt had been made to re-establish the prosperity of agriculture at home. Mr. Baldwin replied that under the Empire Settlement Act no special inducements were offered to agricultural labourers, and although many of the emigrants drawn from urban districts had had some agricultural experience, he understood that very few, if any, regular agricultural workers had taken advantage of the facilities offered.

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REPLIES TO CORRESPONDENTS.

Chinese Method of Corn Growing.—H.S. enclosed a newspaper cutting referring to the "Chinese" method of corn growing as practised in Latvia and asked for information.

Reply : A reference to the "Chinese" method will be found on page 740 of this *Journal* for December, 1909, in a note on a "Russian Method of Corn Growing." The method (it is there stated) "which broadly speaking, depends on the careful cultivation of the individual plant, is not new, as it has often been proposed in the past in this country and constitutes the ordinary practice in China at the present day. The large amount of labour required makes it inapplicable for ordinary corn growing except in countries where labour is very cheap and very plentiful." The main principle is to sow in rows and then after the corn has grown a little to earth it up. The cutting enclosed refers only to the sowing in rows. This practice, combined with repeated earthings up, is traced by a writer in the Spanish Official Boletin de Agricultura for September last to a Chinese Imperial Edict of 1762 B.C. It should be added that the same writer ascribes the renewed interest, in Western agriculturist countries, to the method of sowing in rows to the English Jethro Tull (1674–1740 A.D.).

Eradication of the Lesser Celandine (*Ranunculus Ficaria*).—J.R. asks whether spraying is effective.

Reply : The Ministry has no records of experiments in the use of sprays for control of this weed. Celandine is one of the most difficult of all weeds to eradicate from grass or cultivated ground. It is increased by seeds, and by tubers produced in small clusters an inch or two below ground. The tubers are very easily separated from the parent plant and in digging up the plants there are left in the ground many tubers which produce a fresh crop of plants the following year. The only known method of thoroughly clearing infested ground is to dig up carefully and pick out as many as possible of the plants and tubers, and then keep the ground well worked during summer in order to kill all seedlings. The following spring the ground must be worked very early in order to destroy young plants as they appear, continuing the working until the end of April. The ground should then be cropped by a heavy foliaged crop that may be expected to kill any seedlings that may appear. It is probable that several years may elapse before the ground is thoroughly clean. Thorough and constant working is the most effectual remedy.

Taro.—K.P. asks whether this could be cultivated in England.

Reply : Full particulars of Taro (*Colocasia antiquorum*) are given in the Kew Bulletin, Additional Series, IX (4) p. 755. The yield is from 5,000 to 13,000 lb. of tubers per acre. As, however, it is a tropical plant it could not be grown in the open in this country.

Nauru Phosphate.—L.O. asks for analysis.

Reply : In analyses of 11 typical samples of Nauru Phosphates by Thomas Steel in the *Journal of the Society of Chemical Industry*, Vol. XL, p. 59 T, the

P_2O_5 content varies between 37·57 and 40·44. Only traces of iron or alumina were present in any of the samples and no figures are given. Moisture content was estimated at a temperature of 200° C.

An analysis of Makatea Island Phosphate in Collins' "Chemical Fertilisers," pp. 36 and 37, gives P_2O_5 content at 38·24 and oxide of iron and alumina (taken together) at 1·01. Makatea phosphate is said to bear a very strong resemblance to Nauru.

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NOTICES OF BOOKS.

The Productivity of Hill Farming.—(J. Pryse Howell. London: Oxford University Press. 23 pp. Price 1s.) In the spring of 1918 the Food Production Department decided to conduct an inquiry in connection with sheep-farming in England, Wales and Scotland, the particular object being to collect information in regard to the following points:—

(*a*) Yield of mutton, wool, beef, etc.;
(*b*) Management and quality of the stock;
(*c*) Extent to which bracken, gorse and heather affect the value of the grazing;
(*d*) Possibility of improving hill ground by manuring and drainage, and of growing more winter keep;
(*e*) The need for shelter.

The inquiry was entrusted to Messrs. J. C. Robertson, Fodderty, Dingwall, Scotland (since deceased), C. Bryner Jones, Welsh Secretary to the Ministry of Agriculture, and J. Pryse Howell, now of the Institute of Research in Agricultural Economics, Oxford. A tour was arranged embracing some of the best known and most typical sheep districts in the west and north of England and in Wales. The inquiry commenced on 10th April and was completed on 10th May.

The report now issued gives the statistical results of the inquiry and makes a number of recommendations for the improvement of hill pastures, the most important being (1) a systematic inquiry into the diseases affecting sheep; (2) the burning of heather, gorse and grasses; (3) the more effective control of rams on unenclosed sheep walks; and (4) more efficient management of "commons." The provision of fencing as a means of controlling the stocking and grazing, the planting of timber to afford shelter, and increased attention to drainage and manuring are other measures suggested for increasing the productivity of these areas.

The Soybean.—(Chas. V. Piper, M.S., D.S., and Wm. J. Moore, B.S.A. McGraw Hill Publishing Co., Ltd., Bouverie St., London, E.C.4. 1923. 329pp. Price 20s. net.) Attention has been called from time to time in this *Journal* to the value of the soy (or soya) bean as a food for stock, whether in the form of cake or meal or as a forage crop, and it may be recalled that attempts were made to introduce the cultivation of the plant into this country in 1909, when some seeds obtained from North Japan were experimentally grown at the Midland Agricultural College and at the Cambridge University Farm, with unsatisfactory results which were repeated in further trials in the following year with seeds obtained from Manchuria.

In America, however, the soybean has been successfully acclimatized, and according to official estimates 170,000 acres were grown in the United States in 1920 for seed production, while it is estimated that not less than four times that area was grown for forage, pasture and ensilage. The high yielding capacity of the bean and the ease and cheapness of harvesting the seed, in both of which respects it excels other legumes, while sharing with the latter the favourable effect on the succeeding crop, leave little doubt that it is destined to become one of the major field crops in American agriculture, especially in the Corn Belt area, where it is expected largely to replace oats in the rotations. It was, therefore, eminently desirable to bring together in a single volume the accumulated information concerning this crop, and a glance at the very comprehensive bibliography (wrongly included under the final chapter heading) of the admirable work now issued under the joint authorship of the Agrostologist and Agronomist to the U.S. Department of Agriculture is sufficient to indicate the extent and diversity of the scattered literature in the subject.

It must be said that the authors have performed their task thoroughly. The introductory chapters, dealing with the botanical and agricultural history of the plant and its commercial status, are followed by detailed directions for its culture, harvesting and storage. Tabular analyses are given showing the nutritive constituents of the plant—and it is interesting to note that in the important factor of vitamine content the soybean is stated to be the only seed, so far as is known at present, with the possible exception of flax and millet, containing sufficient amounts of both the water-soluble and the fat-soluble vitamines for the promotion of proper growth. Suceeding sections classify the various uses of the soybean and its products both for human and animal food and for other purposes (such as the use of the oil in soap and paint manufacture), with full information as to methods of utilization, including numerous recipes for the preparation of palatable and nourishing table dishes. The final chapter discusses the enemies of the soybean, but it is satisfactory to learn that no pest has assumed any great economic importance in connection with its culture in America, and that the soybean would seem to be less affected by destructive diseases and insects than are most other forage or food plants.

Allusion has been made above to the very extensive bibliography cited by the authors. It remains to be added that the book is provided with an excellent index and is admirably printed and illustrated. Altogether the work must be welcomed as a valuable contribution to agricultural literature.

Experiments with Oats, 1922.—(University College, Bangor.) In continuation of a series of experiments conducted over a series of years, seventeen varieties of oats were grown in 1922 at the farm of the University College of North Wales, on land which had been cropped with mangolds in the previous year.

As black and yellow oats are extensively grown in North Wales, some of these have been included in the trials every year. On the whole they have not done so well as the best of the white varieties, but it is pointed out that the conditions of the College farm are hardly typical of those under which black and yellow varieties are mainly grown. The fact that many enterprising farmers who have tried white varieties still continue to grow the others is evidence that for comparatively poor soils, and particularly for upland districts of high rainfall, they have a special value.

Of the white varieties tested, "Victory" and "Record" have on the whole proved their superiority, taking into account all the desirable qualities of oats.

"Record" has the stronger straw and is therefore better able to withstand wet seasons, but for drier soils and districts "Victory" is probably the better of the two. Good results were also obtained from "Crown" and "Wide Awake." Potato oats have given good yields of straw, but comparatively little grain.

Of the black varieties tested, "Black Tartarian" continues to hold its own Two yellow varieties, "Golden Rain" and "Goldfinder," proved remarkably similar in every respect but one, that of earliness of ripening, in which the former has always been one of the first while Goldfinder is one of the last. In view of the risk of damage to the crop from delayed harvest, farmers are recommended therefore to husband the Golden Rain—which, by the way, is one of the new varieties produced by the Swedish Seed Institute at Svalof.

The Effect of Silage on the Flavour and Odour of Milk.—(U.S. Dept. of Agri., Bull. No. 1077, Sept., 1922.) This bulletin is a report of an investigation carried out on the Dairy Experiment Farm of the U.S. Department of Agriculture, to determine whether or not the feeding of the different silages affects the flavour and odour of milk, and, if so, how these silages may be so fed and the milk so handled as to minimise their effect on the quality of the produce.

The results obtained confirm the observations made by other investigators that there is a wide variation in the flavour and odour of the milk from individual normal cows receiving the same feeds. While silage-tainted barn air may have some effect on the flavour and odour of the milk, it is of relatively small importance under average and even under extreme conditions. The flavour and odour of silage are largely imparted to milk through the body of the cow. Silage which is fed one hour before milking is so quickly absorbed that its taint is discernible in the milk, it should therefore be fed immediately after milking.

It was found that legume silage affected the flavour and odour of the milk to a greater degree than an equal amount of corn silage. Moderate quantities (15-25 lb.) of corn silage fed after milking, and prompt aeration of the milk, may in some cases actually improve the flavour of milk that would otherwise have a flat or insipid taste.

American Progress on Wart Disease Investigations.—The January Number of "Photopathology" contained an abstract of a paper by Freeman Weiss and C. R. Orton on their investigations into the Wart Disease of Potatoes. Apparently the American season during 1921 was similar in many respects to that experienced in this country; the weather being particularly dry and the temperature hot, under which conditions Wart Disease behaved exactly as it did in this country, giving only slight infection even to susceptible varieties. The American investigators have apparently not been able to associate the retarding of the fungus specifically to either of these factors, though in this country it has been fairly proved that retardation is influenced by soil moisture.

The American investigators are testing most varieties of potatoes for immunity on lines similar to those adopted by this country at Ormskirk, and as the result of the 1921 test they are able to class seven additional varieties as immune, making thirty-four in all out of the one hundred and three varieties tested.

The investigators have continued their experiments in testing host plants other than the potato, including the Tomato, the Egg plant, Peppers, Petunia and Tobacco, but have nothing further to record on this matter than was published the previous year, namely, that the Potato and the Tomato remain the only demonstrative American host plants.

International Agricultural Congress.—The Organization Commission of the Eleventh International Agricultural Congress has drawn up the programme for the Congress, which will be held at Paris from the 22nd to the 26th May next. The Congress will be divided into seven sections:—1. Agronomy (application of sciences to agriculture, agricultural improvements, international war against parasites and diseases of animals, improvement of plants); 2. Influence of Agriculture on international relations; 3. Rural Economy (agricultural credit, co-operation and insurance, agricultural instruction); 4. Live Stock; 5. Viti-culture; 6. Silviculture; and 7. Agriculture of Warm Countries.

The Congress will be composed of official delegates of the governments and of public establishments and associations exclusively agricultural (agricultural societies, syndicates, co-operative societies, etc.) The subscription for each member is fixed at 25 francs.

Communications concerning the Congress should be addressed to The Secretary-General, Mr. Henry Sagnier, at the Office of the Organization Commission, 18, Rue de Bellechasse, Paris.—(*From La Renaissance Agricole, 25th February*, 1923).

The Making of Rural Europe.—(By Miss Helen Douglas Irvine. London: Allen & Unwin. Price 7s. 6d.) The History of Rural England has been written by a master hand in "English Farming Past and Present." In "The Making of Rural Europe" Miss Helen Douglas Irvine attempts the same task for Europe generally. The book is necessarily a summary, but the fascination of the story is as great as we find it in Lord Ernle's classic. The secular struggle between the peasant and his overlord which has its roots in a primeval and ever-present land hunger has profoundly affected the history of all lands. In England we have escaped the latest turn of the wheel—the Green Rising, which, as Mr. G. K. Chesterton, in his preface to Miss Irvine's book tells us, is "a thing like the Great War—a vast victory for the peasants, and therefore a vast defeat both for the communists and the capitalists." In effect, this Green Rising on the Continent of Europe has meant an addition by revolutionary methods to the area of land held by peasant proprietors, a class more numerous abroad than in England.

The greater part, however, of "The Making of Rural Europe" is concerned with peaceful developments. It shows, how, as in England, the mediæval servile tenure of villeinage gradually developed in Europe generally into either proprietership or leasehold. In the words of Sir Henry Maine's famous epigram, it illustrates the transition of land tenancy from "status to contract." It is remarkable to learn that this change set in earlier, and was more complete, in England than in any other European country. "England" says Miss Irvine, "was endowed with shrewdly planned political institutions . . . they were particular in the binding force they gave to the written word," whether that word was inscribed in a lease or in the rolls of the manorial court: there was nothing on the Continent comparable with our "copyhold" tenant. The early, and eventually predominant, hold which industrialism obtained in England was also an operating cause, as well as the development of (to use

Miss Irvine's happy expression) "tentacular" towns with their fatal attractions for countrymen.

Miss Irvine has much to say regarding the métayer tenure which is still a prominent feature of rural polity in the south of France and Italy. Whereas in the north and east of Europe customary tenure was followed by lease for a fixed annual rent, in the south of France, in Italy and in Spain, the tenant has more often rendered a determined share of the produce (generally a half) to his landlord. A distinguishing feature of this tenure has also been that the stock of the farm is the landlord's property and ceded with the land. .Miss Irvine's conclusion is that, on the whole, the métayers of Europe have enjoyed more security of tenure than the tenants who pay a money rent. They, with the small owners, have preserved the family institutions which are still the foundation of Continental rural society.

At the present time small holders occupy 60 per cent. of the arable and meadow land of France, and there are few countries in Europe in which the proportion of peasant farmers is less. It is not the least of the difficulties of establishing smallholders in this country "that the weather is uncertain and the standard of living unusually high." Modern industrial developments have also affected the smallholders' position by weakening the communal life of the village. The stability of the smallholder has always been greater when he could practise a lucrative rural industry as an additional means of support.

The main interest of Miss Irvine's book to the ordinary reader, however, is in the light thrown on the conditions to which the exceptional position of England is due. From the beginning of the eighteenth century, the history of English farming became exceptional. From that date and with the development of America, the Atlantic displaced the Mediterranean as the waterway of commerce. As a result of trade and industrial expansion following invention, vast wealth accrued in England. Farming became almost wholly a capitalist industry, whereas in other countries it is mainly controlled by small producers. As a necessary consequence came the inclosures policy of 1750-1850, and with it the creation of the landless labourer and the increase of paupers.

One of the most interesting chapters of the book deals with the wage-earning labourer. The co-existence of large and small farmers does not necessarily create a class of hired labourers, for the smallholders may be bound to supply labour as a customary incident of their tenure. In the 14th century attempts were made to fix the conditions and pay of labourers by statute both in England and France. The wage-earning labouring class in England was created by the absorption of small holdings into large capitalist farm. The rise of town dwellers in 1860-1900 was from 45 to 68 per cent. in England : from 29 to 41 per cent. in France : and from 34 to 48 per cent. in the whole of western Europe. In England, now, practically the whole of the rural labouring class are wage earners—and the *day* labourers are nowhere important.

The concluding sentence of this extremely interesting work may be quoted, "From villein to customary tenant and from customary tenant to contractual tenant and small owner, he (the peasant) has evolved steadily, and, except in England, has kept his place through much adversity. It is fantastic to suppose that he can be driven out exactly when he has attained to unprecedented political and economic power." The "Making of Rural England" can be confidently recommended to all interested in the land question, the present position of which as well as its historic development in all the leading countries of Europe is traced and suggestively described with great literary skill.

Pigs and their Management.—(H. W. Potts, F.C.S., F.L.S. Australia: August Robertson, Ltd., 89, Castlereagh Street, Sydney, 1923. 262 pp. Price 12s. 6d.) The value of the pig as (in the words of an old chronicler) "the husbandman's best scavenger and the housewife's most wholesome sink" has long been recognised, but it is doubtful whether the raising of this most profitable and most prolific of farm animals has ever received the attention it deserves from farmers and stock breeders in this country. Evidence of the increasing recognition of the importance of pork and bacon production in the Antipodes, both for local consumption and for export, is afforded by the issue of the fourth edition of the excellent book on Pigs and their Management. by the ex-Principal of the Hawkesbury Agricultural College, New South Wales. This book was originally issued about a dozen years ago under the auspices of the Department of Agriculture at Sydney, and the present revised and enlarged edition embodies the results of researches carried out since that date, as well as conclusions drawn from records of successful practice in this and other countries.

Separate chapters are devoted to the discussion of the points of the various breeds, of which it is interesting to note that five of the six recommended as most suitable to Australian conditions are of British origin. Breeding, housing, feeding, sanitation, diseases and parasites, etc., are dealt with, and directions are given for the cultivation of the principal fodder crops and their proper mixture in the diet. The final chapters deal with slaughtering and bacon curing. An index is added, followed by 32 pages of illustrations, of which the first two are reproduced from this *Journal.*

Food:—[Sir Charles Fielding, K.B.E. (Agricola). London: Hurst and Blackett, 1923. 255 pp., 12s. 6d. net.] Writing with the desire to give "a comprehensive view of the whole facts bearing upon English agriculture from the point of view of the Nation at large and the Towndweller in particular," the author, drawing upon a wide study of his subject, advances a mass of interesting facts and figures in support of his contention that this country could produce practically the whole of its food requirements, on which £500,000,000 was spent abroad in 1921, and that its economic future is dependant on the achievement of this end. He refrains from urging any particular line of political policy, confining himself to stating the facts of the existing situation and suggesting the general lines on which agriculture in this country could be improved and intensified, in the assurance, which is echoed by Viscount Milner in a brief preface, that the final solution of the problem lies in an enlightened public opinion, and in the realisation by the urban majority of the nation that their own vital interests are bound up in the maintenance of a prosperous and progressive rural industry. Although the volume is addressed primarily to the townsman, the agriculturist, while he may not agree with all the author's conclusions and suggestions, will find in it much that is of interest and value.

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Continuous Cropping or Farming on Factory Lines, *T. Wibberley.* (Hunter's List of Agr. Seeds, 1923, pp. 71-73.) [63.191.]

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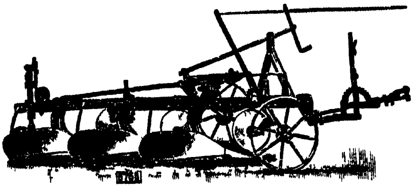

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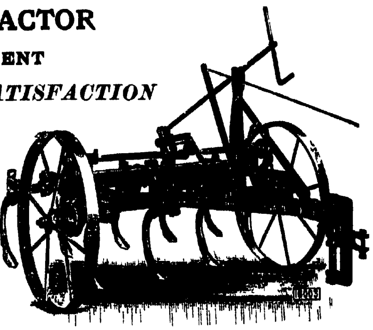

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Vol. XXX. No. 3.

JUNE, 1923.

NOTES FOR THE MONTH.

Royal Visit to the International Institute of Agriculture.

During their recent stay in Italy their Majesties the King and Queen, accompanied by their Majesties the King and Queen of Italy, visited the International Institute of Agriculture on 8th May. In reply to an address by M. Edoardo Pantano, Member of the Senate and President of the Institute, the King said:—

"I thank you, Monsieur le Président, on behalf of the Queen and myself for your eloquent Address, and you, Messieurs les Délégués, for the cordial reception which you have given us.

"The agricultural industry is of vital and universal importance, for it provides not only the actual necessities of life but a firm foundation of social and political stability, while ensuring to a thrifty and industrious population a life under the healthiest of natural conditions. Hence the welfare and prosperity of the agricultural community is a matter of deep concern to the Government and people of every country. I take a personal and active interest in the fortunes and misfortunes of the industry, not only in my own country and in the British Dominions, but throughout the world.

"I am fully aware that, in addition to the uncertainties at all times inherent in agriculture, the industry to-day has to combat special difficulties, owing to the severe fall in prices resulting from the great war upheaval. My sympathy goes out to my fellow agriculturists in their trials and anxieties; but I do not despair, believing that their traditional patience, courage and enterprise will again carry them triumphantly through this present crisis.

"After the ravages of war the way to peace and prosperity is uphill and devious, and perhaps the best and most direct path is to be found along the lines of international co-operation, so admirably followed during the past eighteen years by the International Institute of Agriculture. One of the main functions of the Institute is to supply farmers in all countries with the latest information, practical as well as that based upon scientific research. Year by year the necessity for such an organisation is more generally recognised throughout the British Empire, and the adoption by the Governments and the agriculturists of these up-to-date methods augurs well for the industry's future. Doubtless the same spirit is manifesting itself in this beautiful land of Italy as elsewhere.

" In these and other directions the achievements of the International Institute of Agriculture must always be of special value, and the Queen and I are happy to have the opportunity of inspecting its work. I shall always watch with interest the progress of the Institute, confident that, favoured by the generous support which it has invariably received from His Majesty the King of Italy, and with the hearty co-operation of the adhering States, it will continue to render great services to the most essential and ancient of all industries."

* * * * * *

Agricultural Production in 1922.

THE Ministry's annual report dealing with agricultural production in 1922 has now been published. The report differs from previous issues in that it includes estimates of the production not only of the principal crops but also of early potatoes, onions and various other minor crops, as well as of other agricultural products such as meat, milk, butter, cheese, poultry, eggs and wool, the object being to include within the scope of one report all the information available in regard to the output from the agricultural land of the country.

The special features of the year as regards agricultural production are discussed in the report, and short statements are included with reference to the conditions under which the harvest was carried out and as to the quality of the grain crops. The forecasts of the probable yield of crops which were published by the Ministry in terms of actual yield for the first time last year are reviewed in relation to the final results.

An estimate has been made of the agricultural output in Great Britain, as represented by the value of the products sold off the farms for consumption. The estimated value is given separately for each of several main groups of commodities, and the total output from the farms of Great Britain in 1922 is put at about £260,000,000.

A new and interesting feature of the report is the consideration of the results obtained by the classification of a limited number of holdings with a view to seeing what are their average characteristics. The types of holdings so classified are sheep farms (arable pasture and mountain), poultry farms, fruit farms, milk producing farms and mixed farms of about 30 acres, 150 acres and 300 acres in extent, respectively.

The report, which forms Part II of the Agricultural Statistics, 1922, is published by H.M. Stationery Office, and may be purchased through any bookseller, price 1s.

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Rural Industries.

MUCH has been written since the end of the Great War as to the place of rural industries in the national life. Until comparatively recently, however, there was sadly lacking a really practical attempt to come to grips with the many problems the subject presented, to assist those who were obviously interested but at a loss as to procedure, in directing production and organising sales, to bring about co-operation among the workers in rural industries, and to show where and how definite progress could be made. The organisation of the Rural Industries Intelligence Bureau, however, seems likely to change the position, and to give new inspiration to certain phases of country life and the industries dependent thereon. An attempt is now being made to deal with the question methodically, and in this connection it is proposed to cover the subject generally in a series of articles commencing in this issue of the *Journal.* The fullest support of readers is invited on behalf of the Rural Industries Intelligence Bureau, both by assisting it by every means in their power and by calling upon it for advice.

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Seeds for Grassland.

IN the May issue of this *Journal* there appeared an article, from the pen of Professor Stapledon, of Aberystwyth, on " Seed Mixtures for Grassland." The title, as will no doubt have occurred to many readers, might appropriately have been amplified by prefixing the adjective " simple." In the present issue will be found a contribution from Professor Percival, of Reading, in whom, at any rate for permanent pastures, the more complex mixture finds an advocate. Grassland and its many and varied problems are now receiving the special attention that is their due, and for this reason expressions of opinion from those who are in practical touch with any aspect of so wide a question should be read with more than ordinary interest. In scarcely any department of British farming is it possible to lay down absolute and certain rules of general application, and, as Professor Stapledon pointed out, it is the farmer himself, rather than the scientist, who must constitute the final court of appeal as to what is the best method to adopt on his own land. In the very nature of things, however, the process cannot be otherwise than slow, consisting as it does in proving, not perhaps all things, but certainly a great many things, and then cleaving, though still with a very open mind, to that which has shown itself to be good.

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Importation of Cattle.

THE Ministry desires to draw attention to the fact that the provision contained in the Importation of Animals Act, 1922, for the importation of Canadian store cattle applies to store cattle only as defined in the Act, viz., "Canadian castrated male or spayed female bovine animals which are intended for feeding purposes and not for immediate slaughter." It is not the intention of the Ministry to allow fat cattle ready for immediate slaughter to be treated as stores and allowed to pass through the Landing Places to inland markets and slaughterhouses. Such cattle (*i.e.*, fat cattle) will be removed to the category of animals for slaughter at the port of landing and licences for their removal alive from the Landing Places will not be granted.

The attention of shippers is also called to the requirement contained in Section 6 of the Act of 1922 imposing a fee to be fixed by the Treasury to cover the cost of the veterinary examination of imported animals. This fee has been fixed by the Treasury at 6d. per head in the case of cattle, and 1d. per head for pigs, sheep and goats. This fee will apply to all such animals imported on and after 1st April, 1923, whether from Canada, the United States, Ireland, the Channel Islands, the Isle of Man or from any other country from which for the time being imported animals are allowed to be brought to Great Britain. It must be paid to the Landing Place Authorities (*i.e.*, the owner or occupier of the Landing Place) who will act as the agent of the Ministry for the collection of the fees.

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The Ministry's Leaflets.

THE issue of official leaflets on agricultural subjects dates from the days of the Agricultural Department of the Privy Council, and the Board of Agriculture, which was established in 1889, extended the practice and gave the leaflets a more practical and educational nature By 1904 one hundred leaflets had been published, and in the same year these were collected and published in one volume.

The circulation of leaflets, however, was not large, and even as late as 1910 the annual distribution was only 54,000. From that date the circulation rose rapidly, and in 1912 a million and a half leaflets went out from the Board's offices. Even then a critic is said to have sarcastically remarked that although the Board "flooded the country with leaflets, no farmer had ever heard of them."

A more moderate estimate of the position was made by a Worthing grower who wrote "I have made the acquaintance of many hundred farmers, fruit growers and market gardeners, and I can safely say that not more than 2 per cent. are aware that the Board distributes leaflets containing useful information and advice. To them the *Journal* is an unknown quantity. It seems regrettable that so much excellent and valuable information should be stored up in Whitehall Place when there are many thousands of men who urgently require it, and would eagerly read it did they know how easily it was to be obtained."

It is hardly possible to accept this statement in view of the large number of leaflets issued and of the efforts of Local Authorities, Agricultural Societies and other bodies to draw the attention of farmers to them. Nevertheless, it is true to say that while many farmers had at one time or another read one or other of the leaflets, there remained a considerable number who were disinclined to acquire knowledge by this particular means.

By July, 1913, however, 281 leaflets were in existence and 2 bound volumes of leaflets had been published. The volume containing Leaflets Nos. 1-100 had reached its 11th edition, and that containing Leaflets Nos. 101-200 its 4th edition.

On the outbreak of war an increase in the supplies of home-grown food became of the first importance. The ranks of the skilled farmers were increased by the addition of large numbers of food-producers whose enthusiasm was not always accompanied by a corresponding degree of knowledge, while even farmers of experience required and were ready to accept advice in the new conditions. To meet these needs it was decided to bring out a new series of special leaflets, and by May, 1915, 30 of these had been issued, and nearly 1¼ million copies distributed. The leaflets of this series were intended mostly for the amateur, and dealt mainly with Poultry, Pigs, Allotments, Feeding, and the Preservation of Fruit and Eggs, but certain of them contained information on corn growing and other subjects of primary interest to the farmer. Eventually 104 of these leaflets were issued. In 1917 the Food Production Series was started and of these 61 were issued. This series was intended both for the professional and for the amateur food producer, and was in great demand.

Altogether, during the four war years nearly ten million leaflets were distributed, together with about 86,000 bound volumes of leaflets—the third volume of which appeared in 1915.

After the War the Ministry's publications continued to be in wide request, though the special series were gradually withdrawn or combined with the ordinary issues. To meet the need for economy, the free distribution has been largely restricted, only one or two copies now being supplied to the same applicant without charge. This radical change has decreased the demand for leaflets, but it may well have increased the appreciation of them. During the six months from October, 1922, to March, 1923, 5,900 applications for leaflets were received by the Ministry. In response 24,289 leaflets were distributed free and 52,648 were sold.

The issue of the leaflets in volumes containing them in numerical sequence has also been discontinued owing to the very high prices which it would have been necessary to charge in order to cover the cost. Popular as they had been these volumes also had obvious disadvantages. The grouping of leaflets by consecutive numbers instead of by subjects made both reference to and revision of the volumes very difficult. Smaller volumes of leaflets grouped according to subjects have been substituted for them, and the increasing sales suggest that the public appreciate the change.

Exclusive of the War series, nearly 400 leaflets have now been issued, and of these 138 are included in the eight Sectional Volumes so far issued.

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Agricultural Tractors in Great Britain.

ACCORDING to the returns issued by the Ministry of Transport, the number of 5s. road licences issued in Great Britain in respect of locomotive ploughing engines, agricultural tractors, motor ploughs and other agricultural engines was 17,293 in 1922 as compared with 18,179 in 1921, a reduction of approximately 5 per cent. In order to arrive at the number of agricultural tractors actually in use, additions must be made for tractors used for road haulage and bearing a £6 licence, and for those used for stationary work and field work, but not making use of public highways and not therefore paying licence duty. A deduction must on the other hand be made for ploughing and other engines. Without an actual census of agricultural tractors in use, opinions must differ as to the net addition to be made to the Ministry of Transport's figures, but 25 per cent. would probably be excessive. It is fairly safe, however, to estimate that the total number of tractors and motor ploughs in use in Great Britain at present is not much more than 20,000. Assuming the average life of a tractor to be from four to five years, the annual demand for replacing existing tractors should be between 4,000 and 5,000.

There seems no doubt (as was indicated by the reports from the Ministry's Crop Reporters summarised in the " Agricultural Market Report " for 16th February, 1923) that during the last two years there has been an actual, although small, decrease in the number of tractors in use, but the decrease shown in the number of licences issued is possibly larger than the actual decrease. Farmers may still be employing tractors in respect of which they have not thought it worth while to renew the licences.

Report on Fungus Diseases of Crops, 1920-21.

THE Ministry publishes an annual report on the occurrence of fungus diseases of crops in England and Wales, but owing to the transfer of plant disease work from Kew to the new Pathological Laboratory at Harpenden, the report for 1920 was delayed and has been issued jointly with that for 1921. As the summer of 1920 was cold and wet, while that of 1921 was unusually warm and dry, an exceptional opportunity was afforded for comparing the effect of climate upon plant diseases. An endeavour has been made in the report to show the effect of the two seasons, and weather charts are included which enable this to be studied.

The report takes each crop in turn and gives an account of the extent to which it suffered during the two years from each disease to which it is subject. Notes are added on measures of control, legislation, and recent research in connection with the diseases. In all, 391 diseases are dealt with, forming a complete list of fungus diseases so far known to occur in England and Wales. Of these no fewer than 136 have been added since the publication of the report for 1919.

This report should be of great value to students and writers on the subject, and to all agricultural and botanical departments in colleges and research institutes, while progressive market gardeners and fruit growers will also find it useful not only as a work of reference, but also for the practical advice it contains on the growing of crops. The report can be obtained from the office of the Ministry, price 3s. net, post free.

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The Agricultural Index Number.

OWING mainly to the reduction in the price of milk, the general index number of the prices of agricultural produce showed a further fall in April. On the whole agricultural produce sold at 54 per cent. above pre-war prices, against 59 per cent. above in March, 1923, and 70 per cent. above in April of last year.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April ..	202	149	70	54
May ..	180	119	71	—
June ..	175	112	68	—
July ..	186	112	72	—
August ..	193	131	67	—
September	202	116	57	—
October .	194	86	59	—
November	193	79	62	—
December	184	76	59	—

Wheat and oats rose in price during April, wheat averaging 9s. 11d. per cwt. against 9s. 5d. per cwt. in March, while oats at an average of 9s. 10d. per cwt. were 2d. per cwt. dearer. Barley, however, declined by 1d. per cwt. on the month, but as the fall at this time of the year is usually sharper the index number rose by 3 points. The very large supplies of potatoes caused a further reduction of about 4s. per ton, and brought prices in town markets to 28 per cent. below those of April, 1911-13. Hay remained very steady, average prices being only 6d. per ton lower than in March.

Prices of fat cattle hardened, but the average over the month was the same as in March. As, however, there is usually some increase in April, the index number shows a fall of 8 points.

Fat sheep sold at exactly double the pre-war price, but fat pigs declined to 71 per cent. above 1911-13. The fall in the prices of fat pigs which had gone on steadily from the beginning of the year was checked in the second half of April. Except for the best cattle, dairy cows have been in poor request and prices declined still further, but store cattle, although showing a fall in the index number, were dearer than in March, the rise being relatively smaller than was usual before the war. Store sheep remained at 92 per cent. above the level of 1911-13, but store pigs though still very dear declined somewhat.

The summer prices of milk are not proportionately so much above pre-war prices as those ruling during the past winter, and the average contract prices of milk delivered to large towns during April were about 70 per cent. above the pre-war summer contract prices against 90 per cent. above in the winter Butter declined by 2d. per lb. as compared with March prices, and cheese, owing to the lower prices ruling for new season's cheese, also showed a decline. All classes of dairy produce were, however, appreciably dearer than in April, 1922. Eggs on the other hand were much cheaper than a year earlier, the average price in April being 12½d. per dozen or only 37 per cent. above the pre-war price.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.		1923.			
Commodity.	Apr.	Dec.	Jan.	Feb.	Mar.	Apr.
Wheat ...	57	32	33	28	27	31
Barley ...	49	17	20	12	8	11
Oats	49	36	43	39	36	36
Fat cattle ...	65	48	61	61	54	51
Fat sheep ...	128	81	103	97	94	100
Fat pigs .	90	94	102	88	77	71
Dairy cows ...	47	72	74	67	58	55
Store cattle ...	34	28	36	36	31	29
Store sheep ...	78	83	105	100	92	92
Store pigs ...	95	151	171	154	136	131
Eggs... ...	89	63	86	46	55	37
Poultry ...	83	86	81	80	81	75
Milk	42	90	90	90	87	70
Butter ...	49	73	73	72	70	68
Cheese ...	46	60	85	88	95	92
Potatoes ...	95	7	—1*	—5*	—12*	—28*
Hay	28	47	43	42	42	40

* Decrease

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Conciliation Committees in Agriculture.

THE agreement of the Cheshire Committee providing for the payment of adult male workers at the rate of 32s. for a guaranteed week of 54 hours, with overtime at 9d. per hour and proportionate rates for male workers under 21 years of age, has been extended until 31st October, 1923. The Committee for Shropshire has reached an agreement to run until 27th October for the payment of adult male workers at the rate of 30s. for a guaranteed week of 53 hours, with the same rate for weekday overtime, and 9d. per hour for all work on Sundays. The Shropshire agreement also provides that the Saturday half-holiday should be observed whenever possible, and that during harvest, unless mutual agreements for lump sums are arranged, work in excess of 53 hours per week should be paid for at the rate of 10d. per hour.

At a recent meeting of the Cumberland and Westmorland Committee it was decided that the rates of 37s. for adult skilled workers for customary hours (63 hours per week) and of 30s. for a week of 54 hours in summer and 48 hours in winter for other male workers should be maintained for the hiring period extending to 11th November. The agreement specifies proportionate rates for skilled workers between 16 and 21 years of age, and for a rate of 5d. per hour for female workers of 16 years and over. The North Northumberland Committee has reached an agreement to apply from 12th May, 1923, to 11th May, 1924, providing for payment of adult male workers at the rate of 32s. for a week of 52½ hours in summer, and a shorter working week (to be decided by mutual agreement) in winter, overtime being payable at the rate of 10d. per hour on weekdays and 1s. per hour on Sundays. The agreement also provides for proportionate rates for workers under 21 years of age and for special rates for female workers.

The Lancashire Committee has made a further agreement to operate until 31st October, 1923. The rates for the Eastern area of the county, *i e.*, 40s. per week applicable to teamsmen and stockmen for the usual working hours, remain unchanged. For the Northern area, where the rate for skilled workers is 37s. 6d. per week, there is similarly no change, but the rate will be 35s. in the case of ordinary workers in this area. For the Southern area the rates agreed are 35s. for skilled workers and 32s. 6d. for ordinary workers.

The provisional agreement of the Committee for the Southern area of West Sussex for a rate of 27s. for 54 hours for adult workers has been ratified.

An agreement has been reached by the Suffolk Conciliation Committee providing that from 26th April until one month after notice of termination is given by either side (such notice not to be given prior to 30th September, 1923), able-bodied adult male workers shall receive payment at the rate of 25s. for a guaranteed week of 50 hours, with overtime at 6d. per hour up to 54 hours, and at 7½d. per hour for all subsequent employment. Horsemen and stockmen will receive an additional 5s. per week for their extra customary hours. The wages of male workers under 21 years of age will be at proportionate rates. The Suffolk agreement also contains a clause to the effect that employers shall provide facilities for a working day of not more than 6½ hours on Saturdays, the workers' side of the Committee undertaking that workers shall be available in cases of special necessity (provided that overtime rates be paid).

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Annual Returns of Crops and Live Stock.

THE annual agricultural returns will be collected again this year on 4th June. The forms were issued at the end of May to all occupiers of agricultural holdings, and the returns should be made and forwarded without delay to the Crop Reporter, whose address appears on the back of the form.

These returns afford the only real measure of the dimensions of the agricultural industry, and of the changes in cultivation and the number of live stock from year to year. Tabulated results are the more valuable the earlier they can be published, and all occupiers of agricultural land are urged to complete their returns at the proper date. The returns of individual occupiers will be treated as confidential, and will be used only for the compilation of statistics of economic value to agriculture.

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SEED MIXTURES FOR PERMANENT GRASSLAND.

Professor J. Percival, Sc.D.,
University College, Reading.

The fairly constant recurrence of temporary leys in the ordinary agricultural rotations has given opportunity to the farmer to become practically acquainted with the best mixtures of seeds for the production of such leys. He is aware that the plants used must give good yields of forage or hay, and as the charge for seed is a recurrent one it must be kept comparatively low.

Mixtures of one or two clovers (red, alsike and white) with the rye-grasses, Timothy and cocksfoot, satisfy practically all the conditions essential for success with leys of short duration.

The laying down of arable land to permanent grass is, however, a much more complicated problem, and success or failure can only be determined after a considerable period. The results of sowing a particular mixture may appear satisfactory for the first three or four years, but only the later history of the pasture or meadow can reveal any errors which have been made.

The most obvious and direct method of converting arable land into good permanent grass is to " turf " it with the " sole " removed from a first-class pasture, but little is to be gained by destroying one field to make another. In a modified form this was the essence of the so-called "inoculation" method recommended long ago for changing cultivated fields to good grass. Narrow strips of turf ploughed from a fine pasture were cut into pieces six or eight inches square, and these were planted out on clean well prepared soil at intervals of two or three feet. It was assumed that the unoccupied ground would soon be covered by the spreading roots, creeping stems and seeds of the plants composing the turves laid down. Such a process, however, has many practical disadvantages and need not be discussed further.

The other chief methods which have been widely applied for the production of permanent grass on arable soils are:—(1) " Tumble-down "; (2) the sowing of " hay seeds "; and (3) the sowing of mixtures of commercial grass and clover seeds.

(1) **Tumble-down Pastures.**—In times of adversity when arable farming has fallen upon evil days the temptation to

allow cultivated land to become covered as best it might by diversified herbage derived from seeds present in the soil or carried to it by the wind or other means has been almost irresistible. In the majority of such cases the ground has been allowed to "tumble down" after a temporary grass and clover ley, rather than after a cereal or root crop, in the hope that the plants of the ley would produce abundant seed from which subsequent crops might be expected.

Probably the greater part of the poorest grassland throughout the country which shows the old plough ridge and furrow is the result of this practice, and it is needless to emphasise the futility of such a method as a means of establishing a good permanent pasture or meadow.

(2) **The Sowing of "Hay Seeds."**—The sowing of "hay seeds" taken from barns and the bottom of haystacks, or the use of the miscellaneous seeds obtained from a crop of hay taken from a good meadow gives results little better than "tumble down." Instead of producing a replica of the herbage of the fine grassland from which it has been harvested, such practice leads to uniform disappointment.

The result is readily explained, for examination of such "hay seeds" has invariably shown that the mixture consists of only the few kinds of plants which ripen at the time the crop is cut, most of the best early and late grasses and clovers upon which the high value of the grassland depends being absent.

(3) **The Use of Seeds Mixtures.**—The sowing of mixtures of commercial grass and clover seeds is the only practical means of converting arable land to permanent grass, and experience has shown that there is little difficulty in producing good permanent pasture or meadow on arable land upon practically all classes of soil except those of an exceptionally dry character

To accomplish this, however, it is absolutely essential that certain conditions must be fulfilled. The kind of seeds sown, and the relative amount of each must be carefully planned, and full regard must be paid to the preparation of the land and the time of sowing. Inattention to any of these points will lead to unsatisfactory and even disastrous results, and examples of failure on account of neglect of one or other of these conditions are very common.

Of foremost importance are (1) the species or kind of seeds used, and (2) the relative amount of each in the mixture which is sown.

It is quite useless to expect to produce good permanent pasture by sowing only the seeds of rye-grass and red clover, for most of the plants die out in a year or two and the land sown soon becomes comparatively bare and rapidly overrun by weeds.

The kinds of clovers and grasses adapted for the laying down of permanent grassland are familiar to all seedsmen and others concerned with the preparation of prescriptions for this purpose, and except that unnecessary and more or less useless plants such as sweet vernal grass, yarrow, sheep's parsley, and burnet are sometimes recommended for inclusion in mixtures, there is general agreement in regard to the kinds of grasses and clovers to be sown.

In regard, however, to the relative amount of each to be employed there is difference of opinion and practice, and it is in the disregard of the proper balance between the amounts of the different seeds used in the mixture that nearly all the failures to obtain a good permanent turf of high quality are due. The best permanent grassland of this country which gives palatable and nutritious forage and hay from early spring through summer to late autumn in practically all seasons, consists of a complex collection of plants, and the necessity of the use of many rather than a few species of seeds needs but little discussion.

There is no single clover and grass, or even simple mixture of a few kinds of seeds (such as rye-grass, Timothy, and one or two clovers), which will do more than produce a temporary ley.

The results in the first year or two may be made extraordinarily attractive by excessive seeding of these species, but permanence and the establishment of a good sole of turf are not to be obtained by such means, and recommendations to limit the number of kinds of seeds sown to those suggested are, in the writer' opinion, advocating a national disservice.

Advantages of a Complex Mixture.—The advantages of the complex over the simple mixture are patent. The ground is more densely covered and the different depths of the soil more completely utilised when a variety of plants with different habits of growth are sown than is the case when few are used.

Moreover, a well selected complex mixture in which early, mid-season and late-growing plants are employed yields a crop over a longer period of the year than can be expected from a few kinds only.

In addition, whereas in some seasons all the components of a simple mixture may practically fail, it is unlikely that all the different species of a complex mixture will succumb at the same time, and the chance of a crop is therefore greater whatever the climatic or soil conditions may be.

By far the majority of prescriptions recommended to farmers have hitherto had in them much too high a proportion of rye-grass and red clover, and too low a proportion of permanent plants: these are in reality short-ley mixtures, and although the yield during the first year or two is high, in subsequent years the land becomes comparatively bare, the permanent grasses having been largely smothered or destroyed by the heavy crops of the short-lived plants.

Disastrous results are also not infrequent through sowing too high a proportion of cocksfoot; especially is this the case on the lighter soils where this deep-rooting plant establishes itself much more rapidly than the finer grasses, which it smothers and becomes at the same time coarse and dry, and unpalatable to stock.

The amount of perennial rye-grass should rarely exceed one-quarter and the cocksfoot rarely exceed one-eighth of the total amount of seed sown.

Some Useful Mixtures for Permanent Grass.—The prescriptions given below are especially suited to the production of permanent pasture on the soils indicated; they will be found to give a good yield from the first with little or no diminution

MIXTURES OF SEEDS FOR PERMANENT GRASSLAND.

	Light Soils. lb.	*Medium Soils.* lb.	*Heavy Soils.* lb.
Perennial Red Clover (Single Cut Cow-Grass) ...	2	2	1½
Alsike Clover	—	2	2½
White Clover	2½	2	2
Wild White Clover	½	½	½
Kidney Vetch	2	—	—
Perennial Rye-grass	7	4	3
Timothy	—	2	3
Cocksfoot	3	2	2
Meadow Fescue	1½	3	3
Meadow Foxtail	—	1½	2½
Rough-stalked Meadow-grass	—	½	¾
Smooth-stalked "	1½	1	¾
Crested Dogstail	1	1	1
Hard Fescue or Red Fescue	2	1½	1½
lb. per acre	23	23	24

in the later years where the land receives proper attention annually.

With the exception of the red and alsike clovers which usually die out in the first four or five years, all the plants are permanent, and they cover the ground adequately, when sown in the proportions given on clean land in good condition.

From observation extending over more than twenty years, the writer has found that none of the plants mentioned die out when sown on the soil indicated, although meadow fescue, on account of its erratic production of inflorescences, is in some seasons judged to be absent when the pastures are examined in June.

The amounts of seed indicated to be sown per acre have been found sufficient where the suggestions for the preparation of the land, and time of sowing referred to below, have been observed.

Under less favourable conditions the sowing of 27 or 28 lb. per acre of the same mixture instead of 22 or 23 lb. is advisable.

Golden oat grass (½ lb. per acre) may be profitably added to the mixtures on light and medium soils.

Preparation of the Land —Many of the best grasses are small plants when young, and liable to be crowded out or checked in their growth by weeds. It is therefore essential that the land should be as clean as possible before sowing, and in good condition; an application of about 2 cwt. of superphosphate per acre has been found beneficial.

Before sowing, the soil should be well cultivated, a fine seed bed prepared by harrowing, and the surface rolled. To sow on ground left in a rough state or prepared as for a cereal crop is fatal to good results; much of the seed is buried and lost, and plots badly prepared in this respect have been found at Reading to give very inferior results in comparison with those which were finely harrowed and rolled.

Method of Sowing.—As it is practically impossible to sow a definite amount of seed uniformly over a given area exactly, and have no seed left, it is advisable to divide the seed into two portions and go over the field twice, the separate sowings to be made at right angles to each other. The sowing is best done in the early morning when there is no wind. After sowing the surface should be very lightly harrowed.

Time of Sowing.—There are two periods at which sowing may be carried out, viz., (1) spring, and (2) autumn.

When seeds are sown in spring it is usual to sow them on a cereal crop, in which case the amount of seed used for the cereal should be at least half a bushel less than that ordinarily sown, or the grass may be injured by smothering.

The best time for sowing is the latter half of March: earlier than this, germination is checked somewhat by low temperature; if sown later the young plants are liable to be poorly developed by May and June, when there is danger of loss by drought.

Sowing in autumn without a crop gives excellent results where the land can be properly prepared. The best time is the latter half of August: earlier is liable to be too dry, later is not advisable, as the young plants have not time to become established before frosts arrive.

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THE AGRICULTURAL WORKER.

John Strong, C.B.E., M.A., LL.D.,
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Necessity of Vigorous Country Life.—It is easy to understand that, from a national point of view, a vigorous and healthy country life is of the highest importance. In the past when this has failed national decline has followed. It would seem that successful urban life, apart altogether from the question of food supply, which at times, as for example during war, assumes a magnitude of the first dimensions, is dependent upon the existence of a flourishing rural life. One has only to try and imagine a country entirely denuded of its agricultural population to appreciate this fact. From the point of view of national health and physique there would be untold and irremediable loss. Legislation could not make good the loss of a sturdy race of country labourers.

Again, no one doubts that our national life would be the poorer by a decline in our rural life; but it is sometimes difficult to state in definite terms the extent of the loss. It is well known, however, that contact with the soil leads to an appreciation of nature and natural phenomena which it is difficult, if not impossible, to obtain in any other way. History and literature and art have shown throughout the ages that daily contact with the elemental forces of nature breeds independence of character, virility of mind, constancy of purpose—qualities included amongst those accounted worth while in life. And if perchance, at times, these are allied with other and less desirable accompaniments, the latter, more often than not, are attributable to causes which a well-organised national life could remove or control.

One other point. The possibility of overseas food supplies being restricted in war-time, if not cut off, has been a subject of much discussion, and rightly so. Now this danger has not by any means been removed since the War: neither peace proposals nor more efficient or more destructive engines of war appear to have banished the possibility of war. However much war may be deplored, and however optimistic the supporters of the League of Nations may be, few people have illusions as to the necessity of safeguarding the nation against the possible event of attack. If such necessity is admitted no one can view with unconcern the prospect of a diminishing food production in the future, and the gradual reduction of our agricultural population. This in itself, quite apart from the important reasons already indicated, points to the vital necessity of maintaining an adequate rural population.

Town and Country Complementary.—Insistence on the vital necessity of the rural and agricultural worker to the national life is not made with the intention of depreciating or in any way undervaluing the services of the city-artisan in the national organisation. Each has his part to play; the one is complementary to the other. What is to be deprecated is the possibility of a gradual reduction of the number of rural workers and a corresponding increase in the number of urban workers.

Far from misprising the work of the city-artisan we cannot overlook the fact that much of his work has had to do with the wonderful development in power, whether steam or electrical, in modern times, and the possibly even more wonderful inventions in machines and mechanical appliances, which have made available a higher standard of living for a greater number of people than at any previous time in the history of civilisation. Indeed, the multiplication of mechanical contrivances and machinery generally has itself helped to bring about the great aggregations of population in certain localities. But the relatively greater increase in the number of city artisans has already shifted the centre of gravity of the population far enough in the direction of the towns and cities, and if, as it is argued, further transference would tend to deprive the national life of a valuable and essential element, it behoves the State to take stock of the situation and consider what steps to take to provide remedies. The purpose of this article, however, is not to discuss at length such remedies, but rather to make clear the essential factors in the situation, and, in particular, to emphasise the necessity and importance of a contented and vigorous rural and agricultural element in the national life, and to point out that without such an element a nation such as ours would tend to a position of unstable equilibrium.

Two Fundamentals of Labour.—From whatever angle it is viewed it is clear that an adequate rural element is essential to the permanence and stability and full development of our national life. There remains the problem as to how this rural element may best be conserved and strengthened. At the outset two fundamentals stand out clearly and must be considered: (1) adequate provision for decent living; and (2) opportunities for self-development. Both are of the first importance and should be considered in relation to one another. On the one hand, if the worker pulls his weight, and we assume that in the aggregate he does, he is entitled to a wage which will provide him and his family with at least the decencies of life. On the other hand, the worker and his family are entitled to live their lives not only as members of a community sharing and participating in its common joys and sorrows, but also as individuals improving and developing such talents and tastes as nature has endowed them with. It is not enough that the rural worker should have the wherewithal to *exist;* he should be so circumstanced as to be able to *live.*

More than 2,000 years ago Aristotle put the case clearly when he wrote in his *Politics:* "the whole of life is divided into two parts, business and leisure, war and peace, and all our actions are divided into such as are necessary and useful and such as are fine." In the past the tendency has been to overlook the fact that the rural worker, toilsome and exacting as his work may be, ought to have leisure for such things as are "fine" if he is to live his life in a way which will lead to real self-development. His comparative isolation, apart from other factors incidental to his work, has rendered him in the past less ready to look after his own interests than his fellows in the city.

Wages and Costs.—Now many will regard decent living as impossible with wages of less than thirty shillings a week. No matter how strong is the urge towards a life in the country, such a wage will inevitably impel men cityward, especially the younger men, where, at least in normal times, a living wage can be earned by an honest worker. If one may judge from recent Press reports, the National Farmers' Union is quite alive to the seriousness of the situation. As matters appear to stand at present the employers cannot pay higher wages without incurring charges which they cannot afford. Already we are told that many farms are being worked at a loss, and obviously there is a limit to this sort of thing.

On the other hand it is open to question whether producers are making the most of their possibilities in the way of organising the distribution of their produce. Clearly, there is something wrong with a system which allows of so great a difference between the prices of food stuffs paid by the consumer and those obtained by the producer. To the man in the street it seems absurd for the corn-freight, say, for a distance of 20 miles in this country, to be greater than the cost of conveying the same from New York to Liverpool. Even more absurd is the case in which potatoes were sold to consumers in Leeds at prices ranging from £6 to £8 a ton, while the farmer, who had grown them some thirty miles away, received only 30s. a ton. Obviously, the question of organisation in the distribution of farm produce is in a crude and elementary state in this country. No doubt this and similar questions are occupying the careful attention of the producers as well as the Committee appointed by the Government to inquire into this and other matters pertaining to agriculture. It is obvious that just as the co-operative buying of fertilisers and farm implements has done something to reduce the cost of production, so, it is reasonable to suppose, should co-operative distribution mean not only an increase in revenue for the producer, but also a decrease in cost to the consumer. Yet, whatever means are adopted to reduce the costs of production, it is certain that unless a decent wage is paid to the agricultural worker the tendency will be for all but a few to desert the country and gravitate towards the town.

Two Lines of Development.—Even if decent wages are paid to the rural worker this tendency will remain, though possibly latent, unless some effort is made to try and equalise other conditions in urban and rural districts. This effort may be directed towards (1) modifying and developing rural education, and (2) making further provision, social and intellectual, for after-school life. In neither of these directions has effort been sufficiently well organised or as deliberately planned as it might be.

The problem of school studies in rural districts has still to be solved. It is admitted that rural education has been greatly improved in recent years, particularly in the remote and outlying districts of Scotland, but it still leaves much to be desired.

Here and there one meets with schools, which, contrary to the formerly prevailing practice, are not now giving their pupils a bias towards the selection of indoor or urban occupations on leaving school. Such schools provide a course of study well calculated to foster a love of country life and a taste for outdoor farm life, a healthy, satisfying life to many lads, who, under former conditions, would have been led to choose urban occupations for which they were unfitted, and in which they would wilt and lose their vitality. If the material rewards of the rural worker were comparable with those of the urban worker this bias towards indoor and urban life, whether given in rural or urban schools, would no doubt tend to disappear.

Various devices have been suggested to encourage an interest in farm life. For example, part-time labour after the age of 12 or 13 has been advocated, but the great objection to this is that it would tend to mortgage a child's future. On this ground alone it would be difficult to justify it. Moreover, it is unnecessary, since a pupil who has a taste for country life can have that fostered if rural schools provide suitable courses of study and encourage a spirit which does not affect to despise agricultural labour.

Interests and Tastes in Rural Schools.—This interest in country life could be encouraged without unduly emphasizing the vocational aspect of education, and most certainly without starving that side of education which will bear more directly upon the right use of leisure in after-school life. To a large extent the happiness and contentment of rural workers in the future will depend upon the cultivation of the proper kind of interests in the adolescent and pre-adolescent stages. In itself a decent wage is not sufficient, something more is required. It is as true now as when it was first said, that man does not live by bread alone, and especially true is its application to the case of the rural worker. Interests must be cultivated and fostered, interests and tastes which will make life more worth while for the individual and more worth while for the community. One of the chief among these is the reading habit. The school has still to recognise its possibilities in the fostering of this habit. Few pupils brought up in the right environment fail to acquire a love of reading. How far it satisfies some of the more permanent human instincts and desires is shown in the extraordinary extent to which advantage has been taken of the Public Libraries Act all over the country. The love of reading is only one of many interests which can be encouraged and fostered in a properly organised rural school. It would be immensely interesting to develop this line of thought, but space will not allow.

Rural Social and Intellectual Life.—There remains for our further consideration the subject of the social and intellectual life of the rural community. Much thought has been devoted to the methods of ameliorating the lot of the rural worker and with some success. Experiments of various kinds have been and are being made. Village clubs for men and women, village institutes, travelling cinemas and peripatetic libraries are some of the means employed, all with more or less success.

It will be observed that, in general, effort so far has been directed to trying to approximate the social life of the country to that of the town. But this does not seem to be altogether sound. The city is not a sure guide in a matter of this kind. It should be remembered that one's outlook on life is immensely influenced by occupation and environment. Rural occupations and environment are in the main different from those in the city. There is not the same bustle or excitement in the country as in the town, nor the same opportunity for the quick spread of opinion or rumour. In general, the individual is thrown more on his own resources and his work is less minutely specialized. All this is amply illustrated in the daily work of the agricultural labourer. Leisure to a rural worker has a significance of a different kind from what it has to an artisan in a city. Finally, the community of which he is a part is small and well-defined. There are fewer opportunities for breaking up into sections and, in the main, less need—at all events in social life.

Such considerations as these have pointed to the desirability of instituting an organisation in each village through which the various existing elements might be co-ordinated for social purposes. Such an organisation would incorporate the activities of existing Village Institutes, Village Clubs, Reading Rooms and the like. It would require to be housed in suitable buildings. These would tend to become centres of social life for the cultivation of interests and hobbies, both recreative and cultural. Reading and debating societies, lecture courses of all kinds, study circles, local musical and dramatic societies, would find here a local habitation. The possibilities are great and await systematic development. Further, this is work which might reasonably be subsidised by the Government and by the County Authorities. Such a development would have a profound influence on rural life, and not the least of its benefits would be the opportunity it would provide for the discovery and the training of talent in rural districts. If rural life is to compete successfully with city life it needs not merely the stimulus of relatively equal wages for the agricultural worker but the stimulus of a relatively equal social and intellectual life

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VILLAGE LIFE AND COUNTRY INDUSTRIES.

THE following article is the first of a series on rural industries, which is being prepared by the Rural Industries Intelligence Bureau.* While this first article is concerned with general aspects of the problem of rural industries, subsequent articles will deal in detail, and from a practical standpoint, with specific industries which already exist or may be revived or established in country districts.† These articles will subsequently be available in pamphlet form for circulation to those interested in the general question or in any of the industries dealt with. Applications for copies of these publications, inquiries arising from them, and requests for further information on the subject matter should be addressed to the *Secretary, Rural Industries Intelligence Bureau*, 258/262, *Westminster Bridge Road, London, S.E.1.*

There is no need to argue the case for restoring or maintaining the activities of village life. It is desirable in the interests of agriculture, of wholesome social development and of the physical health of the people. Such a revival will depend on the extent to which it is possible to extend the range of employments and to vary the interests of the rural population. No one, who compares village life as it was and as it is can fail to be struck by the former diversity of its interests as contrasted with the present monotony. Apart from the different grades among occupiers of land, there were the small shopkeepers, the carrier, the pliers of various handicrafts whether for domestic or agricultural use. Now the occupation of the lard is uniform; the other means of livelihood are passing away; the population consists, more and more exclusively, of farmers and labourers. Year in and year out, employers and employed are face to face without any intervening grades, and the latter are dependent on the former for their wages and their homes, without any alternative means of livelihood unless they migrate to the town. Instead of being gay the villages are patient, and patience ceases to be a virtue where it passes into fatalism. Rural life would be made infinitely more varied and attractive if country industries could be revived or established on an economic basis. Experiments in this direction are worth trying and more particularly in the case of those industries which have shown the greatest tenacity of existence. If tried, they should be tried at once.

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* The nature and objects of this organisation have already been described in this *Journal*, Vol. XXIX, p. 348, and notices of its establishment and activities have appeared from time to time in the Press.

† A brief article on "Hurdle Making by Machinery in North Wales" appears on page 267 of this number of the *Journal*.

The crisis through which agriculture is passing must seriously affect such rural handicrafts as those of the blacksmith, saddler and wheelwright. Once extinguished, these trades can only be restored with the utmost difficulty. Placed on a more business-like footing, they may hold their own and even become a means of employment to others.

Obviously country industries cannot be revived by attempting to put back the hands of the clock and run counter to economic forces. But economic forces do not all side with the town, and the country is not yet an industrial desert. There are still to be found, for instance, blacksmiths, carpenters, hurdle and fence makers, saddlers, wheelwrights, shoemakers, dressmakers. milliners, spinners, weavers. Many of these trades are in the last stage of extinction by the industrial revolution; but in the instances where they have adapted themselves to new conditions, they still flourish. Machinery, after drawing industry away to city factories, is now creeping out to the effective help of villages and farms in the shape of motor buses. cheap cars and lorries, tractors and small power units. The village inn has been restored to prosperity by motorists: factories themselves have in appreciable numbers moved to country sites to avoid high urban costs. Natural sources, such as streams, rivers and wind are still used, and might be more fully used, to generate power. It has been well said that "the essential problem of the decentralisation of industry is one for the engineer; it is that of the decentralisation of power at low costs." (A. W. Ashby: "Rural Problem.")

There is. however, a social as well as an economic attraction to the town which must be taken into account. It is not only that rural life is voted "dull" and that young people want dances and cinemas, but the careers which it offers, whether on the land or in the village workshop, are laborious and unattractive compared with the shorter hours and lighter work of the towns. Boys will not ply the saw or swing hammers by the hour as their fathers and grandfathers did. They know instinctively that such manual labour is out of date. It is in fact uneconomic as well as unpopular, and the demand for leisure and for variety of experience, and the rebellion against long hours of heavy bodily work, unassisted by modern machinery, are entirely natural and hopeful symptoms.

To sum up, the principal economic difficulties which country artisans have to face are: competition of factory-made articles, rivalry of shops in towns, decay of apprenticeship, want of market facilities beyond their immediate neighbourhood, and lack of capital and credit which makes the installation of plant and machinery so difficult as to be prohibitive. Generally speaking, country artisans are being or have been reduced from manufacturers to repairers, and even in repair work the townsman often competes successfully. Taking all drawbacks into account, it is not surprising that the village workshop has been left behind.

No survey of rural industries will be attempted here.* It will be sufficient to quote one or two pieces of evidence, gathered at first-hand, in illustration of the position and needs of some of the village workers.

In a special report to the Rural Industries Intelligence Bureau on conditions in Oxfordshire it is pointed out that where, fifteen to twenty years ago, there was work for three smiths one is now sufficient: that where, before the War, three saddlers were employed only one is necessary; that, during the last twenty years, wherever a village wheelwright has died, his shop has generally been closed, and consequently that the local industry is gradually becoming extinct. Here and there, however, enterprising men are making a stand. Among the forty smiths visited, two had installed welding plant and found plenty of work, and four or five had equipped their shops with machinery capable of coping with the more complex repairs of agricultural implements. Several of the Oxfordshire smiths are urging the formation of a co-operative society for the supply of spare parts for agricultural engines and tractors.

The wheelwrights who were visited stated that factory-made carts had a much shorter life than those made in the country and needed thorough repairing after two years' use. The initial cost of the factory-made cart was, however, as a rule lower, and the town agent would generally give longer credit to purchasers than the country wheelwright could afford to allow.* Inquiries made in Herefordshire of a wheelwright, who employs electric power and possesses a good set of machines, show that farm carts and wagons can be made on the spot at a less cost than those supplied by the wagon works. Where electric power is not available oil engines produce satisfactory results. The country boy may be once more attracted by the puff of the engine or the buzz of the circular saw.

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* The full material for a complete survey is not yet available, though steadily accumulating from various sources.

By common consent, the outlook for saddlers and wheelwrights as at present equipped is gloomy. At the same time the impression given by competent observers in almost every part of the country is that it is not too late to save the remains of local skill. The village wheelwright, for instance, has many advantages that the town manufacturer lacks. He possesses the traditional skill; his materials are ready to hand and can be inexpensively seasoned; his overhead charges are trifling; his potential customers are at his door. But without proper equipment he cannot quote a price to a customer, who, fresh from an Agricultural Show, desires to order a type of cart that he has seen exhibited. He therefore ceases to be a builder and becomes only a repairer. With credit facilities, advice on the best machinery and power, and reliable information on prices and markets such as the Ministry of Agriculture already provides for the farmer, many a competent man might be set on his feet. Nor need the skilled village artisan entirely depend for a living on the farmers' custom.† Country houses, small and large, and the upkeep of their estates may be valuable clients. Often, also, a small piece of land supplements the resources of himself and his family.

To secure the revival and expansion of village life the first step clearly is to maintain and develop the little centres of local skill provided by village handicrafts. If any kind of industrial work is to be provided in the country for wider markets than those of the immediate locality, it is essential that the village artisans should have the necessary equipment and that they should be put in touch with traders or distributors of semi-manufactured goods. Similarly, they ought to be enabled to extend their businesses to " side-lines " for which there is always a local demand.

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* It must be admitted, also, that the country-made cart is often heavy. Lightness is a selling point to which the local wheelwright would be well advised to give more attention. With better equipment there is no reason why he should not be able to make a strong light cart as easily and economically as a heavy one

† In Derbyshire and Leicestershire, "the big houses rely on the wheelwright and carpenter for all repairs and sometimes for the making of doors and window-frames, and all the villagers must come to him at last for their coffins." (Report by Oxford Institute of Research in Agricultural Economics).

There are, of course, a considerable number of traditional hand industries surviving in country districts, such as hand spinning, handloom weaving, and the preparation of reeds and osiers and the making of baskets and matting, and various underwood trades. These employments can often meet local demands satisfactorily, but for the supply of distant markets, organisation and information are required. Prices are often inadequate and are undercut by competition of individuals or districts. The want of organisation prejudices producers, drives large buyers to deal with foreign importers, and deprives small English industries of the advantage of the proximity of the home market. In this field it is clear that an efficient intelligence service, such as the Rural Industries Intelligence Bureau hopes to create, and assistance in organising the collection and distribution of orders which Country Industries Limited is prepared to offer. have abundant scope for usefulness.

It is interesting to notice the economic limits within which handicrafts and small industries may flourish side by side with the more centralised forms of urban production. Hand-spinning and hand-weaving do not compete with textile factory goods in the mass production of cloth, where uniformity is no disadvantage, but rather a recommendation or even an essential. The costs of producing the hand-made article are higher because the labour and skill required are greater and the output is slower; but if the product has superior quality and character, it may command a higher price in a special and limited market. Small industries again which supply the varying requirements of individual customers, such as the making of elastic stockings and other silk woven goods for surgical use, do not compete with urban products. Made to measure, they are produced in Leicestershire on the old hand-frames, because this is still the only method of production. Again, the Intelligence Bureau lately had an application from a firm requiring a few pieces of woven material of a particular character too small and special an order for an ordinary weaving factory. In this case a small hand-weaving industry was able to give a satisfactory estimate. Lastly, the command of local supplies of raw materials is another obvious advantage which sometimes enables small trades to hold their own, as in the case of underwood industries.

Country industries are sometimes identified with those " arts and crafts " in which machinery is regarded as the enemy, and excessive stress is laid on the element of hand-work. No hard and fast line can be drawn between hand-work and machine-work, since the most elaborate machine has been evolved in the course of countless inventions from a simple hand tool. Nor is there any definite dividing line between "artistic crafts" and the products of ordinary industry. Where, for instance, does a basket cease to be industrial and become artistic? Certain highly-skilled hand-industries, however, on account of some special quality, excite an interest which may be disproportionate to the amount of their output and their purely economic value. The most successful always depend on the exceptional gifts of individuals, who are few in number, because originality in art is always rare, and probably no rarer now than at previous periods. The best work always commands its market, though not always its due price. But those less richly gifted may often be helped to succeed by such technical or artistic advice, or such information on sources of material, as the Intelligence Bureau is able to provide.

In this connection it is important to note the need of linking up industries producing hand or machine-made goods with the educational institutes which turn out skilled designers. Without such a link, competent students, some of whom are highly gifted, can only hope to become teachers of drawing, while the average factory is satisfied with the mechanical repetition of designs of little artistic merit, or, at the highest, with attempting nothing more original than a "reproduction." One function of advisory organisations, such as the Rural Industries Intelligence Bureau and kindred agencies concerned with the organisation and training of handicraft workers, is to see that where openings exist for skilled and original artificers and designers they shall not be left out.

The revival of handicrafts has received considerable stimulus from the National Federation of Women's Institutes, which has formed over 2,700 institutes scattered over the country. The institutes are doing valuable work in training women to supply their own domestic needs—a highly important branch of rural industry; and the instruction given by their teachers is also available for those who desire to make a living or to supplement their income by handicrafts.

In the ordinary course of trade a considerable amount of home-work is still done, chiefly by women, for large firms in the towns. In Somersetshire, Wiltshire and Worcestershire, for instance, gloving and clothing firms give out work to the surrounding villages which can better be done by hand or by hand-worked machines than by power-driven machinery. Similarly, in Leicestershire villages hand-knitting is done at home for shops both in the county and in London. To many families such work provides a valuable supplementary income; and domestic industry of this nature is no doubt capable of extension.

This system has its dangers. If unregulated, it gives the opportunity for sweating. Scattered and unorganised workers are liable to exploitation, where their market depends on the ordinary trade channels. These dangers can only be met with the help of advisers experienced in industrial organisation, and the Committee of the Rural Industries Intelligence Bureau are prepared to recommend precautionary regulations.

In this connection, also, the establishment of Country Industries Limited* is important. This Society, formed to act in close co-operation with the Bureau as a disinterested middleman, provides methods of trading, which can hope, in many cases, to secure for workers larger returns than they would otherwise receive.

The problem of reviving industries in country districts is made more urgent by special conditions arising out of the War. For a large number of disabled ex-Service men employment in urban factories is often neither desirable nor possible. Many of them can only work under exceptionally healthy conditions at their own pace and in their own time. The Rural Industries Intelligence Bureau is, therefore, carefully considering the possibility of developing in the country certain industries and handicrafts which can provide disabled men with a suitable occupation and enable them to become self-supporting.

The maintenance or revival of rural industries is not a forlorn hope. They are not doomed to extinction by irrevocable economic laws. Village artisans in the more backward and remote districts need to know the possibilities of utilising power and machinery; they require advice on design and other technical points, as well as on the kind of goods for which there is a demand and the locality of suitable markets; they want information on costs and prices, and the purchase of raw materials. With these needs the Rural Industries Intelligence Bureau is prepared to deal. It has experts in its employment and at its disposal as advisers on the technical, commercial and artistic sides of production. Its Committee of Management includes representatives of different Government Departments through whom it can avail itself of the best information on home and overseas trade, on the industries allied with agriculture and on the available facilities for technical and other training—a concentration of intelligence for which no other agency yet makes satisfactory or sufficient provision.

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* This *Journal*, Vol. XXIX, p. 549.

It is clear that, in addition to advice, practical help of other kinds is much needed. The rural artisan not only wants to know what machine to buy and where; he also requires credit or some system of purchasing his plant by instalments. Small industries in the country districts feel the lack of means of marketing, even where the market is known, and the disadvantage of being compelled to sell in very small quantities or employ expensive middlemen. The same difficulty hampers the business which requires raw material in such small quantities that it can only buy retail. A strictly economic middleman or wholesale merchant of material, etc., who would also organise credit in suitable cases, would meet these difficulties. It is for these purposes that the trading association, Country Industries Limited, which has already been mentioned, has been formed by those interested in the Rural Industries Intelligence Bureau, in order to carry on the commercial activities which are necessary to its success.

Little, however, can be done directly from London. To enable the central organisation to put its resources at the call of local needs, intermediaries are indispensable, and for every reason co-operation must be sought with the many people and agencies who are already at work in the country, some of whom have long and valuable experience. The local officers of the Ministry of Agriculture are co-operating with the Bureau and will make known the opportunities offered. Where Rural Industries Sub-Committees, appointed from the County Council's Agricultural Committees, still exist, they are the natural heads of the work in the counties. Other bodies like Women's Institutes, Village Clubs, and Arts and Crafts Associations are natural allies; and it may be hoped that the branches of the National Farmers' Union, and of the Workers' Unions, seeing how closely their own interests are involved, will be prepared to co-operate. The formation of County Rural Community Committees, representative of all the bodies interested in the development of county activities under the National Council of Social Service, will, it is hoped, give a fresh impetus to the work. On the trading side, Country Industries Limited is ready to advise on the formation of local co-operative societies for the organisation of workers and of trade, and, if required, to act as their agent. A combined effort, concentrated on both production and distribution, may, it is hoped, restore and establish on economic lines that variety of profitable occupations on which the prosperity and happiness of village life so largely depend.

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A TRIAL OF HARVESTING MACHINERY.

BINDERS AND A BINDER AND STOOKING MACHINE.

II.

The Tractor-drawn Binder.—The modern binder has been established for many years on recognised principles and may be relied upon to perform its operations efficiently and well; for this reason little mention has been made in this report of the quality of the work done by these machines. It may be accepted that the latter was uniformly good, whether drawn by horse or by tractor. The tests were designed to give some indication of the economic possibilities of the tractor-drawn binder and it will be seen that only negative results as regards the cost per acre were obtained in the case of the single binder drawn by a Fordson. Even taking into consideration the difference in the weight of the crops, a very small saving seems likely to be obtainable, and within the limits of experimental error, it cannot safely be asserted that any appreciable saving can be expected from the use of a tractor in this manner.

When two binders were drawn by a tractor there was on the other hand an appreciable saving in the acreage cost of about 15 per cent. This is probably a conservative figure.

These results are consistent with the previous experience of the Ministry with tractor-drawn devices. The full economic advantage of the tractor cannot be obtained unless it is drawing the full load of which it is capable; a wastage of fuel results when only a fraction of the available drawbar load is utilised. In the case in point the drawbar pull needed for the two binders even on the heavier crop of wheat was only 1,250 lb. which is well within the capacity of the Fordson. It is therefore clear that even greater economy would result if two binders each having a full 8 ft. cut were drawn in this manner, provided the field was sufficiently large and the land reasonably light and flat. When very large fields with light crops and few weeds are to be harvested, such as exist in the United States and Canada, it is of course practicable to hitch three binders to one tractor and the economy is thereby very considerable, but the extreme difficulty of negotiating the corners of the smaller fields of the English farm with such a combination, makes it unsuitable in this country except in the rarest cases.

The Mechanical Stooker.—Even with the advent of the binder there still remains a considerable amount of hand labour necessary in the operation of harvesting, notably in stooking the sheaves after cutting. This operation does not require skilled labour and is fairly rapidly performed. Nevertheless it involves an additional cost of from 1s. 3d. to 2s. 0d. per acre, as evidenced by the data obtained in these trials, and any machine that could effect a practical elimination of this charge would reduce harvesting costs correspondingly.

The McCormick stooker is the first machine of its kind that the Ministry has had the opportunity of putting to the test and contrary to expectations it has been found on analysing the data, that no material saving in cost resulted from its use, at any rate in its present stage of development. Since as many as four men are required to keep pace with a binder in stooking a field and this operation can be done without additional hand labour by the McCormick stooker attached to a binder, it appeared that a considerable saving of expense must necessarily result. That this expectation was not wholly justified can perhaps better be understood by an examination of the figures in the tables of cost. Attention may be drawn to the following points:—

1. The average cost of cutting an acre of wheat and stooking it by hand was 7s. 5d. Of this sum 1s. 11d. or approximately 26 per cent. represented the cost of stooking, and the cost of stooking oats by hand represented 22 per cent. of the total cost. Twine represented on an average 42 per cent. of the cost of cutting, and approximately 38 per cent. of the total cost of cutting and stooking.

2. The stooking machine uses a considerable amount of twine, the value of which represents about 9d. per acre, and it is obvious that this additional charge, together with a few pence per acre for capital charges on the stooking machine, cannot leave a wide margin of saving over the cost of hand stooking.

With these considerations in mind, taken in conjunction with the fact that these trials proved the use of a single binder drawn by tractor to be uneconomical, it will be appreciated why the binder and stooker did not effect any considerable saving.

In conclusion it must be repeated that the foregoing must not be interpreted as discountenancing the construction and use of a mechanical stooker. The fact that the device can in its present form show a small saving over hand labour points to the production of an improved and cheaper machine which will materially reduce the cost of stooking. It is clear, for example, that a stooking machine that could operate without the use of twine, would eliminate the most considerable item of cost, and should effectively establish its economic superiority over hand labour where large acreages have to be harvested. It is understood that such a machine is already in existence and was used in the last American harvest.

General Binder Troubles.—The subject of binder troubles is too large to be treated adequately here, but it is hoped that the following notes consequent upon the Ministry's investigations will be of service:—

If a machine fails to start, the trouble may be localised by following these directions:

(1) Throw the binder out of gear, use the raising and lowering handle and turn the packer crank shaft.

(2) Put the machine in gear, remove elevator chain, and start machine. This should cause the shaft, cutter-bar and knife to operate.

(3) Remove the reel chains, replace elevator chains and start again. This will test the elevators. While the reel chains are off, spin the reel by hand.

It is appreciated that many faults may be easily discovered without this procedure, but this systematic examination will ensure the location of any trouble.

Gear and sprocket wheels.—Hook-shaped sprocket teeth will cause chain breakage. The hook shape of the teeth is caused through the chains being attached with the bar of the link first. Make sure, therefore, that the chains are mounted on to the sprockets in the correct way. Badly-worn gear wheels are usually due to either (a) bad meshing, or (b) the use of oil when working in sandy or very dusty conditions. (a) An adjustment is usually provided by means of which the gear wheel may be moved along the shaft. The teeth of the pinion wheel should engage with the teeth on the large bevel wheel in such a manner that they will neither strip nor be deep enough to cause binding. (b) The combination of oil and sand or dust makes a mixture which causes the rapid wear of gear wheels and sprockets. Under such circumstances it is advisable to run the gears dry, but better still is the use of dry or flaked graphite.

Canvas creeping or broken slats are usually caused through the elevator not being square, or else the tension of the canvas being greater on one side than the other. The canvas should always be slackened at night in case of heavy dews, otherwise it will stretch and become misshapen.

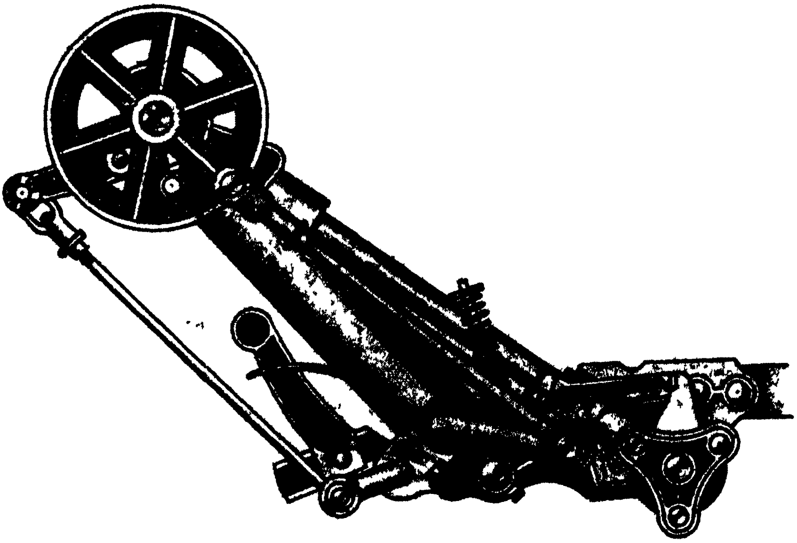

FIG. 7.—Binder Head showing Adjustable Connecting Rods for Needle Shaft (right) and Stop Arm holding Dog (right corner).

Heavy draught results from poor lubrication and too tight chains. The tension on the chains may have been caused by raising the main frames and so increasing the distance between the main chain sprockets.

Badly-shaped sheaves are due principally to the incorrect manipulation of the levers. The levers provide a very efficient means of adjustment for every condition of crop, but full advantage of them is not always taken.

A frequent fault of operators is that when dealing with short crops they pull back the buttor instead of moving the binder head to the front. A good position for the buttors is to be as nearly perpendicular to the deck roller as possible. If the buttors are kept approximately in this position the head will have to be shifted, and by this means much of the trouble of uneven or angled butts will be avoided.

Binder Head and Knotter Troubles.—Every fault which arises round this part may be located according to its particular symptom. The following are examples of faults which occur :—

(*a*) Discharge arms fail to revolve exactly, or fail to start. This is due to dog trouble. The dog is a piece of mechanism which momentarily engages the head with the continuous motion of the dog driver on the packer shaft. A dog spring causes the dog to move when released, so that should this spring be ineffective, the trouble previously stated will result. The remedy is to fit a new dog spring.

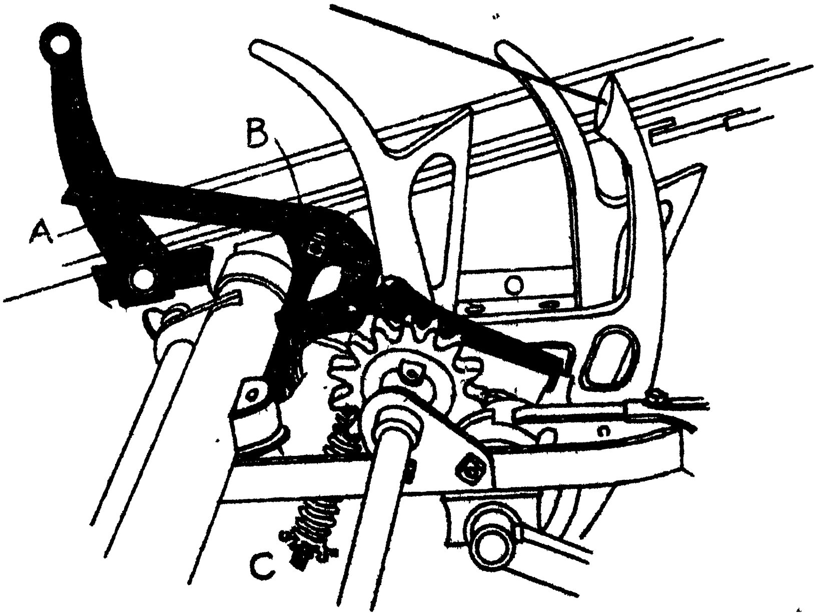

FIG. 8.—Shafting Mechanism.—A, Compression Arm ; B, Trip Lever ; C, Trip Spring.

(*b*) Discharge arms revolve continually. All the working parts of a binder head, with the exception of the packers, work in a definite relation with each other. If this relation is broken, one or more parts are said to be out of time. The trouble with the discharge arms revolving continually may be caused by

TABLE I.—GENERAL RESULTS calculated for a Working Day of 8 Hours.

WHEAT.

Device	Labour Employed		No. of Cutting Hours	No. of Man-Stooking Hours	Total Acreage Cut and Stooked per 8 Hours	Costs per 8 Hours			Acres Cut per Hour	Cost per Hour	Cost per Acre		
	Cutting	Stooking				Cutting	Stooking	Total			Cutting	Stooking	Total
						s d	s d	s d		s. d	s. d.	s. d.	s. d.
Massey-Harris Horse Binder	1	4	8	21·5	6·8	41 0	13 2	54 2	85	6 9	6 0	1 11	7 11
McCormick ...	2	4	8	30·8	10·04	59 9	20 0	79 9	1·33	9 11	5 11	2 0	7 11
Two McCormick .	3	8	8	55·2	19·00	90 7	34 6	125 1	2 375	15 6 5	4 9	1 10	6 7
McCormick Binder and Stooker	2	—	8	—	9·1	68 5*	—	68 5	1 13*	8 6 6	7 6*	—	7 6

OATS.

Device	Labour Employed		No. of Cutting Hours	No. of Man-Stooking Hours	Total Acreage Cut and Stooked per 8 Hours	Costs per 8 Hours			Acres Cut per Hour	Cost per Hour	Cost per Acre		
	Cutting	Stooking				Cutting	Stooking	Total			Cutting	Stooking	Total
Massey-Harris Horse Binder	1	4	8	28·24	10·7	49 8	17 7	67 3	1·33	8 4·5	4 8	1 7	6 3
McCormick	2	4	8	26	12·07	61 9	16 3	78 0	1·51	9 9	5 1	1 4	6 5
Two McCormick	3	8	8	44·8	21·9	94 8	28 1	122 9	2·73	15 4	4 4	1 3	5 7
McCormick Binder and Stooker	2	—	8	—	12·1	74 4*		74 4	1·5*	9 3·7	6 1*	—	6 1

* Cutting and Stooking.

TABLE II.—DETAILED COSTS.

WHEAT.

Device	Time occupied	Total acreage	Average costs per acre						Cost per ton
			Cutting				Stooking	Total	
			Labour	Fuel	Capital charges*	Twine†			
	hrs. mins.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Massey-Harris Horse Binder	3 3	3·00	0 8	—	3 1‡	2 3	1 11	7 11	2 6
McCormick	4 23	5·45	1 0	1 10	0 11	2 2	2 0	7 11	1 11½
Two McCormick	6 36	15·35	0 9¼	0 11½	0 9	2 3	1 10	6 7	1 9
McCormick Binder and Stooker	4 59	6·65	1 1	2 0	1 7	2 10	—	7 6	1 11½

OATS.

Device	Time occupied	Total acreage	Labour	Fuel	Capital charges*	Twine†	Stooking	Total	Cost per ton
Massey-Harris Horse Binder	4 41	6·25	0 5½	—	1 11‡	2 2⅓	1 8	6 3	2 9½
McCormick	11 31	18·50	0 10	1 3½	0 9	2 2½	1 4	6 5	2 3
Two McCormick	2 19	4·90	0 8⅓	0 8½	0 8	2 2½	1 3½	5 7	1 10
McCormick Binder and Stooker	3 37	5·30	0 10	1 3	1 2	2 10	—	6 1	2 4½

* Including interest on capital, depreciation and repairs.

† 4 lb. twine per acre for each binder with the addition of 1⅓ lb. per day for the stooking machine.

‡ Including hire of horses at 5/- per day per horse.

(1) the dog being out of time, or (2) the dog slipping past the stop arm. To remedy (1): while the discharge arms are held in their usual position of rest, the dog should be forced back against the spring as far as possible, and then the whole dog casting should be slipped into position so that the faces of the stop arm and dog just meet. If any play exists between the stop arm and dog after the gearing is meshed, adjust further. (2) The dog slips past the stop arm when the striking faces of the dog and arm become worn to such an extent that the dog can raise the stop arm enough to pass around a second or a third time. If the condition is not very bad, the discharge arm will only make a second revolution occasionally, resulting in a small bundle following a large one. If the construction of the arm is such that its striking face cannot be given a half turn, then a new dog and stop arm will have to be supplied.

Sheaves which are too tight or too loose.—There is an erroneous idea that this difficulty can be overcome by tightening or loosening the twine tension on the twine cam. Actually, however, the tightness of the sheaf should only be regulated by means of the trip spring. A tight trip spring will require more straw to overcome its tension, and hence the bundle will be tighter, or vice versa.

Explanatory to Tables.—Table I, including the general results, has been calculated for an 8 hour working day to provide a common basis on which the respective capacities of the various machines may be judged.

In order to make the costs as comparative as possible it has been assumed that the capital cost of the various tractors was the same throughout, and the charges for interest on capital, depreciation and repairs, have been calculated on a common basis.

Costs computed from the data actually obtained during these tests are not strictly comparable, as regards the binder and stooker owing to variables introduced, such as the speeds and rates of fuel consumption in the different types of tractors used—difference in the capital cost of the tractor—difference in the weight of the crops cut. The first two have been eliminated by standardising the results on the assumption that a Fordson Tractor was used throughout the trials and a uniform speed was taken as a fair indication of the efficiency of each machine based on the actual results taken in the field. Fuel consumption has been calculated on the actual consumption of the Fordson used in the trial. No attempt has been made to compensate for the difference in the weight of the crop, since any such attempt would have involved the introduction of very arbitrary standards, but as the actual difference in weight recorded was negligible, there can only be a small experimental error.

CLEAN MILK PRODUCTION AND THE MILK AND DAIRIES (AMENDMENT) ACT, 1922.

ON 1st July, 1923, the Milk (Special Designations) Order, 1923, will come into operation, superseding the Milk (Special Designations) Order, 1922, and the Milk (Special Designations) Amendment Order, 1922. The Order carries out the intention of Clause 3 of the Milk and Dairies (Amendment) Act, 1922, by providing for official recognition of various grades of milk, and lays down the regulations applying to the production and sale of each grade.

The Order aims, in the spirit of the Act under which it is framed, at securing a better milk supply with the least possible interference with the producer and distributor. It provides for the dairy farmer an opportunity to gain official recognition of the grade of milk he is prepared to place on the market, and at the same time gives to the consumer reasonable assurance that, if he orders milk of one of the recognised designations or grades, he will be supplied with milk which has been produced in accordance with the regulations laid down for that grade.

For their own protection all milk producers should make themselves acquainted with the requirements of the Act, whilst those who wish to obtain a licence to sell milk under one or other of the special names provided for in the Order should obtain the Order, with the explanatory memorandum issued by the Ministry of Health.* A summary of the main provisions of the Act and Regulations will be found at the end of this article.

Aids to Clean Milk Production.—The following advice is offered to those who are desirous of producing milk of high hygienic quality.

If the herd of cows is healthy the production of a clean and healthy milk supply does not present any very great difficulties, and should be the aim of every dairy farmer in the country. The elimination of loss by souring should alone be a sufficient incentive to improve methods.

Health of Cows.—Great care should be taken not to sell milk from cows suffering from any disease of the udder.

Water Supply.—The water supply should not be liable to contamination from surface drainage, this being a frequent cause of serious trouble. Cows should not be allowed to wade in the water from which they drink.

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* Memo. 77/Foods, either through a bookseller or direct from H.M. Stationery Office, Imperial House, Kingsway, London, price 2d. per copy.

Milkers.—Attention should be paid to the health and cleanliness of the milkers. Soap, water, and towels should be provided for washing, and no person suffering from or in contact with anyone suffering from a contagious or infectious disease should be allowed near the milk. The provision of overalls kept specially for milking is a great help.

Buildings.—Healthy cows made comfortable and happy will produce more milk than cows kept under bad conditions. Buildings should be constructed with this end in view, as well as to provide housing in which cows can be kept reasonably clean with a minimum amount of labour. Where old, badly-constructed buildings exist much can be done towards the production of clean milk by the frequent removal of manure, ample provision of litter, and grooming of the cows.

The construction of the cowshed does not in itself exert very much influence upon the germ content of the milk, and is never an insuperable barrier to the production of milk of good hygienic quality.

Cleanliness of Cows.—The hind quarters, flanks, udder, teats, and the part of the belly immediately in front of the udder should be groomed with a currycomb and dandy brush each day when the cows are tied up. Immediately before milking the udder and teats should always be washed, and this can most conveniently be done by having two buckets of water, one for taking off the thick of the dirt and the other for finishing with. The cloths used for this purpose should be thoroughly washed and sterilised each day. A little personal care in this respect and the use of covered milking pails will greatly reduce bacterial contamination and will almost eliminate the visible dirt in milk.

Milking.—Dry hand milking should always be practised, and when the cow's udders and teats as well as the milker's hands are regularly and systematically washed, it will become comparatively easy and is certainly more cleanly than wet milking. A little vaseline may be used when the cow's teats are tender or the milker is suffering from rough hands, but only the smallest smear of vaseline should be used, and care must be taken that the milk never touches the hands. In cases of sore teats the milk should not be mixed with that offered for sale. The first few streams of milk from each teat should be rejected and may be collected in a separate vessel for feeding to calves, pigs or poultry.

Care of Utensils.—Milking stools are often an undetected source of bacterial contamination of milk and should be washed and scrubbed frequently.

Milking pails, strainers, straining cloths, washing cloths, and brushes are all frequent sources of contamination unless great care is taken to wash and sterilise them after each time of using. The cloths should first be washed in warm water to which a detergent has been added, in order to get rid of the grease and dirt, after which they may be sterilised in the sterilising chamber or by being immersed in actually boiling water for a short time. Brushes may be similarly treated.

Milking pails, strainers, measures, travelling churns, and all vessels which have been used in connection with milk should be rinsed out with cold water as soon after use as possible. This also applies to the cooler. Neglect to do this or the use of hot water on milk vessels before they have been rinsed out with cold water will result in a thin film—almost like a coat of varnish—being formed on the surface of the vessels. After the first rinsing, the utensils should be thoroughly scrubbed with hot water to which soda or other detergent has been added and again rinsed with clean cold water.

Sterilisation.—The washing described above will get rid of the visible or observable dirt on the utensils, but nothing short of sterilisation will get rid of the invisible or bacterial dirt.

The object of sterilisation is to destroy as much of the germ life in the utensils as possible and also to leave the utensils in such a condition as to prevent any possible germ growth during the period when not in use. This can be accomplished by the immersion of the smaller utensils in boiling water for 10 minutes whilst the cooler and milk churns should have boiling water poured over or into them until they become unbearably hot.

A much more convenient and effective means of obtaining sterilisation is by means of steam, which may be generated either in a kitchen copper or a specially made steam generating boiler. For the smaller vessels a steaming chest or chamber into which steam is passed from the boiler may be used. The steaming period will vary from 10 minutes upwards according to the supply of steam and the size of the box. If a thermometer is inserted through a small hole in the lid or side, a temperature of 210°F. is sufficient evidence that the utensils are being satisfactorily treated, and the steaming should be prolonged to allow the contents of the box to reach this temperature. Vessels inverted over a steam jet should be kept in position until every part of the vessel is too hot to touch with the hand and left for at least three minutes thereafter.

If a copper is available it can be adapted for sterilising purposes by boring a hole through the centre of a wooden lid and fitting a plug. It has been found that the steam from a properly boiling copper is sufficient to sterilise utensils in from 5 to 10 minutes according to their sizes. Buckets, churns, etc., can be sterilised by inverting over the opening in the lid, and smaller vessels by placing in a steamer which may be improvised by using the receiver of a milk cooler or separator. The smaller utensils should be placed on an open wire bed so lodged that the bed is raised about three inches from the lid of the copper and the whole covered with the receiver from the cooler or the separator, over which, in order to assist in the retention of heat, a thick cloth should be placed.

If properly sterilised, vessels should dry automatically, and unless they do so the process is not complete and should be continued. Improperly sterilised moist cans are a source of grave danger, which is not minimised by attempting to dry off the moisture with a cloth. When not in use smaller utensils should be inverted on a slatted shelf and churns are best inverted on a wooden rail about 6 inches from the floor and 9 inches from the wall, to allow of a free passage of air and at the same time prevent dust from getting into the vessel. After sterilisation the cooler should be retained in the steaming chest, or if this cannot be done, it should be hung in position and covered with a clean cloth until required for use again.

Strainers.—Where the foregoing methods have been carried out carefully the strainer will only be required to take out occasional hairs and dust that may have got into the milk, but these should be so limited that the straining cloth should show but very little evidence of extraneous dirt even where considerable quantities of milk have passed through. The motto of the dairy farmer should be to "keep out dirt," not "take out dirt" from the milk.

Straining cloths, if used, should be thoroughly sterilised after each time of using; otherwise they may be responsible for souring the whole supply of milk in a very short time. The use of cotton wool straining pads will prevent this.

Construction of Utensils.—Thorough cleaning will be made easier by using only well-tinned utensils, having the seams flushed smooth with solder and without corners or crevices. Rusty utensils and those with the tin rubbed off are difficult to keep clean.

For washing, the cooler should be taken off its stand and placed in a tub, on its own feet; if allowed to rest on the edge of a tub the bottom becomes dented and uneven. A strainer should not be included as part of the cooler.

The receiver or pan of the cooler is easy to clean, but special attention should be given to the tap. Most new taps have no cavity and no crevices.

Advice and Demonstrations.—In order to create interest in the clean milk movement, competitions and demonstrations are being arranged at some of the principal agricultural shows. Many of the County Education Committees have arranged for a member of their dairying staff to qualify to give instruction and advice on the production of clean milk, and are prepared to provide demonstrations of clean milking on any farm within the county on application being made to the Agricultural Organiser at the County Education Offices. The Ministry earnestly hopes that farmers wherever possible will take advantage of these opportunities, in order that the milk supply of the country may be placed above reproach.

A brief summary is attached of the provisions of the new Act and Regulations.

Summary of the Act.—The Milk and Dairies (Amendment) Act, 1922, affects in several matters milk producers and purveyors generally, even though they may not wish to sell their milk under any of the special designations mentioned therein.

Briefly, the most important features of the Act as they concern the milk producer and retailer are :—

(1) Any Local Authority by whom a register of milk purveyors is kept may remove from the register any retail purveyor of milk if they are satisfied that the public health is endangered by any act or default of such retailer. The latter, however, if not satisfied with the Authority's decision has the right of appeal (within 21 days) to a Court of Summary Jurisdiction, and the Local Authority or such retailer has a further right of appeal therefrom to the next practicable Court of Quarter Sessions. The retailer may, in the meantime, carry on his business as purveyor of milk until the final decision is reached.

The Court before whom any person registered as a purveyor of milk is convicted of any offence under this Act may, in addition to any other penalty, on the application of the Local Authority, remove him from the register for such period as the Court may think fit.

(2) The Act provides that after 1st January, 1923, milk shall not be sold under any of the following names, viz., "Certified," "Grade A," "Pasteurised," or under any other prescribed designation, or under any name including or resembling any of the descriptions mentioned, unless a licence to do so has first been obtained.

(3) No milk shall be sold or exposed for sale to which has been added any colouring matter, or water or any dried or condensed milk or any fluid reconstituted therefrom, or any skimmed or separated milk; nor can any liquid be sold as milk in the making of which dried milk or condensed milk has been used, milk in the latter case including skimmed milk and separated milk.

(4) The sale, or exposing for sale, of milk from a cow suffering from tuberculosis of the udder is prohibited, and an offence against the Act is committed if it is proved that by the exercise of ordinary care, the disease could have been detected. Any person guilty of such offence is liable on summary conviction for a first offence to a fine not exceeding £20, and for a second and subsequent offence to a fine not exceeding £100 or to imprisonment with or without hard labour for a period of six months, or to both such fine and imprisonment.

(5) Any person guilty of contravention or non-compliance with any of the provisions of the Act, save as otherwise provided in the Act, is liable on summary conviction to a fine not exceeding in the case of a first offence £5 and in the case of a second or subsequent offence £50, and if the offence is a continuing one, to a further fine not exceeding 40s. for each day during which the offence continues.

(6) No person shall be convicted of any offence under any enactment relating to the sale of milk in respect of a sample of milk taken after the milk has left his custody and control, if it is proved to the satisfaction of the Court that the churn or other receptacle in which the milk was contained was effectively closed and sealed at the time when it left his custody and control but was not so closed and sealed at the time when it reached the person by whom the sample was taken.

(7) Where the registration of a retailer is refused or a retailer is removed from a register under this Act, the retailer shall not be liable to any action for breach of contract for the purchase of further supplies of milk from a producer if he can prove that such refusal or removal was due to the quality of milk supplied by the producer.

The Milk (Special Designations) Order, 1923.—"*Certified*" milk is the same grade of milk as that previously sold under the title of Grade A (Certified).

"*Grade A* (*Tuberculin tested*)."—The regulations applying to the production and distribution of this grade of milk are now such as can be complied with by almost any milk producer who is prepared to submit his herd to a tuberculin test and to eliminate therefrom any animal which reacts. The main conditions to be observed in the production of this class of milk are the same as for Grade A with, in addition, a six-monthly tuberculin testing of the herd and the elimination of any reactors, and with the modification that, in consequence of the enforcement of the tuberculin test, the clinical examination is required only once in every six months. The milk must not at any stage be treated by heat.

"*Grade A Milk*," as defined in this Order, is milk from cows which have passed a clinical examination (*i.e.*, a thorough inspection) by an approved veterinary surgeon once in every three months and any animal showing signs of any disease likely to affect the milk injuriously must be removed from the herd. The milk produced by this herd must not contain at any time before it reaches the consumer more than 200,000 bacteria per cubic centimetre. In short, this is milk produced from a healthy herd in a cleanly manner. The milk shall not at any stage be treated by heat unless a licence to sell such milk as "Pasteurised" has been obtained, in which case the milk when sold must be labelled "Grade A Pasteurised," and at any time before delivery to the consumer must not be found to contain more than 50,000 bacteria per c.c., and no coliform bacillus in $\frac{1}{100}$ c.c. in a sample taken before 1st January, 1924. After 1st January, 1924, the maximum count permissible will be reduced to 30,000, with no "*coli*" in $\frac{1}{10}$ c.c.

'*Pasteurised Milk*" as defined in the Order is milk which not having previously been treated by heat is retained at a temperature of not less than 145° and not more than 150° Fahrenheit for at least 30 minutes and immediately cooled to a temperature of not more than 55° Fahrenheit.

After pasteurisation such milk must not be found to contain more than a specified number of bacteria per c.c.; and the Order specifies that this maximum number shall be 200,000 per c.c. for the current year and, from 1st January, 1924, 100,000 per c.c.

Licences: How to obtain them.—For the production of "Certified" and "Grade A (Tuberculin Tested)" milk, licences are granted by the Minister of Health.

The Licensing Authority for the producer of "Grade A" milk is the Council of the County or County Borough, as the case may be, in which the milk is produced. Where a producer bottles and retails it at or from the place of production and has no separate premises, this Authority will grant an inclusive licence to cover distribution as well as production. In all other cases the Licensing Authority is the District Council, or Town Council, or Metropolitan Borough Council, as the case may be.

The procedure and conditions for obtaining a Grade A licence alone are outlined below. For fuller particulars see the Memo. 77/Foods referred to.

What to do to obtain a Licence for the Sale of Grade A Milk.—Application should be made in writing to the County or the County Borough Council in whose area the applicant's farm is situated, together with an approved veterinary surgeon's certificate showing the results of an examination of the herd carried out not more than one month prior to the date of application.

In the case of a producer only, the fee for an annual licence is £1 1s. 0d., but where a producer bottles his milk and retails it at or from the place of production and has no separate retailing premises, the same Authority will grant a single inclusive licence to cover distribution as well as production, the fee for which is £3 3s. 0d. The cost of the licence and veterinary inspection must be paid by the farmer. Licences expire annually on 31st December.

Conditions under which Licences are granted.

(i) A herd book or register of all the cows in the herd (showing additions and removals) must be kept and all the animals must be suitably marked for purposes of identification.

(ii) An examination of the cows in the herd must be made once in every three months by a veterinary surgeon, nominated by the Licensing Authority. Any animal showing evidence of any disease which may injuriously affect the milk must immediately be removed from the herd and information as to its disposal given to the Licensing Authority.

(iii) If tubercle bacillus is at any time found in the milk the producer must arrange for bacteriological examinations of the milk to be made so that the diseased animals may be identified and removed from the herd.

(iv) The milk must be despatched from the farm in unventilated sealed containers, bearing a suitable descriptive label with the address of the farm, the day and time of production (morning or evening), and the words "Grade A Milk."

(v) If the producer retails his own milk he must fill it into bottles either at the place of production or at separate bottling premises. Each bottle must be closed with a suitable tightly fitting disc and covered with a suitable outer cap overlapping the lip of the bottle and so fastened as to form a secure seal. This cap must bear the name and address of the distributor, the day of production and the designation "Grade A Milk."

(vi) The milk at any time before delivery to the consumer must not contain *bacillus coli* in one-hundredth of a cubic centimetre and must not contain more than 200,000 bacteria per c.c.

(vii) Producers must keep records to show the quantities of the milk produced and the name and addresses of the purchasers except when sold by retail.

(viii) Every facility must be given at all times to any person authorised by the Licensing Authority to inspect the premises, processes of production, equipment, methods and records, and to take samples of the milk (free of charge).

Refusal to Grant, or Revocation of, Licence.—A producer's licence shall not be suspended or revoked by reason only of his milk being found not to comply with the conditions of the licence after it has left his custody and control, if he proves that such non-compliance was not due to any act or default of himself or of his servants or agents.

If a licensing authority—other than the Minister of Health—refuses to grant a licence, a person aggrieved by such a decision may within seven days appeal to the Minister, whose decision shall be final.

* * * * * *

RED CLOVER.

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RED Clover (*Trifolium pratense*) takes high rank among fodder plants, not only on account of the quantity but also of the quality of its produce. It is one of the most common and widely distributed of the clovers.

A large number of different types of red clover occur; they may conveniently be classified as follows :—

1. Wild or Indigenous Red Clover.
2. Cultivated or Commercial Red Clover :
   - (*a*) Broad Red Clover.
   - (*b*) Late-Flowering Red Clover or Single-Cut Cowgrass.

Red clover is put on the market under various descriptions, mostly comprising the name "cowgrass"; seed sold under these names is generally only a strain of either broad red clover or late-flowering red clover.

Description of the Plant.—Red clover as a crop is generally treated as a biennial, that is to say, as lasting for two years; some strains certainly last no longer, but others persist for quite a number of years. The plant may therefore best be regarded as a short-lived perennial.

On the other hand but few strains survive the harvesting of two successive crops, or the taking of a hay and seed crop in the first year. Most strains have more or less deep-going tap roots, and produce a number of stems bearing an abundance of leaves, each made up of three broad leaflets, which are usually more or less hairy. The flower heads are generally fairly numerous and vary from deep red to delicate shades of pink.

Wild or Indigenous Red Clover.—This form is of lower growth than the commercial strains, the leaves are usually smaller and the stems tend to be more woody; a great number of forms occur. The majority of the wild red clovers flower early in the spring.

Wild red clover is met with in fair abundance on some types of old grasslands, chiefly on fairly heavy soils and perhaps to the greatest extent where the grass is periodically mown for hay. Wild red clover is not usually a striking feature of the highest class permanent grasslands.

Broad Red Clover.—The commercial strains of broad red clover are very variable; some have spreading hairs on stems and leaf-stalks, while the stems of others have short close-lying hairs, or are sometimes almost smooth. Broad red clover usually flowers about ten days to nearly three weeks earlier than late-flowering red, and will usually flower freely during the autumn of the year of sowing. It grows rapidly after a first cutting and will thus produce either two hay crops or a hay crop followed by a seed crop.

Late-flowering Red Clover or Single-cut Cowgrass.—This variety is not only later than broad red but produces more stems with considerably more side branches, especially towards the top of the stem. Late-flowering red clover seldom produces any appreciable number of flowers in the year of sowing; it only flowers once in the following season, and although, of course, producing some aftermath, does not normally develop sufficiently to yield a heavy second hay crop: nor will it produce a crop of seed after a hay crop. Late-flowering red clover is decidedly hardier than broad red, and, largely on account of its producing but one crop of fully developed shoots in the first year, it is very much longer lived.

Broad red clover and late-flowering red clover cannot be distinguished easily by the characteristics of the stem, leaf or flower: it is only the manner of growth and time of flowering which afford definite grounds for differentiation.

It must be pointed out that strains of broad red clover are to be met with which flower nearly as late as late-flowering red, whilst early strains of late-flowering red are not uncommon.

Description of the Seed and Impurities—It is not possible to distinguish between the seeds of late-flowering red clover and broad red clover, although the former perhaps tend to be slightly larger, probably owing to the fact that this seed has of necessity to be harvested from the first and only crop of the season. The seed of the wild red clover can similarly not be distinguished with certainty from the commercial forms, although it is usually decidedly smaller than commercial seed grown in Britain and smaller than that from most other sources, while it often, but by no means always, contains a greater proportion of yellow seeds.

The shape of the seeds of red clover is a slightly flattened oval. At the wider end there is a marked projection (caused by what is known as the "radicle of the embryo," the part of the seed which becomes the root of the plant). The colour at the broad end varies between light and deepish purple or violet, shading down to yellow or greyish yellow at the narrow end. A sample will generally also contain a certain proportion of wholly lemon-yellow, yellow-ochre and brown seeds. A well harvested and well matured sample should be bright and have a good colour range, but poorly harvested samples and old samples will be of a uniform dull brown appearance and will contain but few, if any, purple, violet or bright yellow seeds.

The country of origin of red clover seed is a matter of very great importance. It is therefore desirable to be able to distinguish between seed obtained from the several different sources, and particularly between foreign and home-grown seed. This is a very difficult matter, but it is none the less possible for the farmer himself, with a little practice, to distinguish with fair accuracy between home-grown seed and that from certain groups of exporting countries. The chief points of difference are :—

(*a*) The character of the weed seeds contained in the sample.
(*b*) The weight and size of the seed.
(*c*) The proportions of seed of different colours met with in the sample.

The following notes with respect to the seed of the chief nationalities of red clover should be of some assistance in differentiating between samples.

Home-Grown : English and Welsh Seed.—All the best strains of late-flowering red clover seed should show evidence of having been harvested in this country.

English clovers are seldom harvested under such favourable climatic conditions as are those from most of the exporting countries. Consequently a fair proportion of brown seeds should not be held to count against the sample, and provided that the sample is pure, germinations of over 75 per cent. should be considered reasonable. English and Welsh samples generally contain considerably less yellow seed than the majority of foreign and Colonial samples, and especially than Chilian, Italian or Canadian.

British-grown seed is usually larger and weighs more per thousand grains than seed from abroad, with the exception of Chilian seed.* Obviously, British samples should not contain seeds of foreign impurities. There are no impurities that may be regarded as typically British, although excess of Cut-leaved Crane's-bill (*Geranium dissectum*) is more usually associated with British than other samples.

Dodder is sometimes met with in English clover fields; its presence in samples cannot therefore be taken as evidence of foreign origin. Should seeds of lucerne, chicory, or ox-tongue be present with the dodder, there would be good grounds for regarding the sample as not wholly of English origin.*

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* The following are the average weights per 1,000 seed in grammes for some of the chief nationalities :—Chilian 2·24, British 2·00, Canadian 1·63, Italian 1·69, French 1·55, Wild (Indigenous) 1·53.

Chilian Seed.—This is the largest of the commercial seeds, the samples are always of a bright, bold appearance, and usually contain over 80 per cent. of yellow seed. The germination is invariably high. Most samples contain at least a trace of the large dodder (*Cuscuta racemosa*, var.), and, like most of the foreign clovers, frequently contain lucerne.

Canadian, French, and Italian Seed.—The seed of these nationalities is small, usually with fairly high percentages of yellow seed. Dodder is not infrequent in these samples, the "Chilian" dodder being sometimes found in samples purporting to be Canadian and the European dodder in French and Italian. Seeds of Timothy and of alsike clover are very frequent in Canadian samples, whilst lucerne is particularly frequent in Italian and French samples. Both these nationalities are characterised by the presence of ox-tongue (*Picris echioides*), whilst sulla (*Hedysarum*, spp.) is frequent in Italian samples, and wild carrot (*Daucus carota*) more plentiful in samples from France than from other sources.

Central European Seed.—Seed from these sources is intermediate in size between British on the one hand and Canadian, French and Italian on the other. Dodder is a more frequent impurity of these than of other European samples, both the large and small species being freely met with. Lucerne is perhaps even a more common impurity than in Italian samples, whilst mayweeds in large or appreciable amount are more often met with in red clover from Central Europe than from other sources. Ribgrass (*Plantago lanceolata*) and docks (*Rumex*, spp.) are met with in samples of red clover from practically all sources.

Agricultural Uses of Red Clover.—Red clover is very largely used in rotations, and is also freely used as an ingredient in seeds mixtures for leys of various duration and in mixtures for permanent pasture.

Rotations and Two-Year Leys.—In the south of England red clover is chiefly grown as a pure crop for one year, whereas in the north and in moister districts generally it is largely sown with either or both the rye grasses for one- or two-year leys. When used alone the amount of seed sown varies considerably from district to district, but 16 lb. of high grade seed (or if lower grade seed is used, the germinable equivalent of 16 lb.

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* See Leaflet 326, Injurious Weed Seeds in Grasses and Clovers Harvested for Seed in Britain.

of high grade seed) is for most districts to be regarded as a maximum seeding. In East Anglia the seed is usually drilled into a cereal crop at a rate of seeding varying from 8 to 17 lb. per acre. In mixtures with rye grasses the amount of red clover is usually about 7 to 10 lb.

Remunerative crops of red clover, whether pure or in mixture, cannot be grown at frequent intervals on the same land; it usually needs four years, and often a much longer period, before the soil will again be capable of yielding a good crop. Land which has become incapable of growing clover is termed "clover-sick": this is frequently due to infection of the ground with the fungus *Sclerotinia trifoliorum*, to eelworm (*Tylenchus devastatrix*) or to a joint attack of both, and it may sometimes possibly be due to the *Glœosporium* disease of clover.*

The ordinary biennial broad red clover is usually employed in rotations largely on account of the greater winter keep, earlier hay crop and greater aftermath which it provides, though it should be noted that a good late-flowering strain will generally produce the heaviest hay crop.

There appears to be no doubt that British strains of biennial red clovers are capable of yielding more hay and aftermath, and of affording more winter keep, than the foreign clovers. For one-year leys English broad red from the Eastern Counties is probably the best, but certain broad red clovers from the Western Counties, such as the Vale of Clwyd red and Dorset marl, are, by virtue of their greater persisting qualities, more suitable for two-year leys.

Chilian, New Zealand, and American medium are probably the best foreign clovers for one-year leys, but for two-year leys preference should be given to Canadian and Brittany red clover and to clovers from Bohemia. Italian clover should never be sown.

For stubble and winter grazing broad red grown in the Eastern Counties is undoubtedly the best, while Chilian is apparently the best of the foreign clovers.

Long Leys and Permanent Mixtures.—The various strains of late-flowering red clover (single-cut clovers) should always be used in seeds mixtures for three years and upwards since they are more persistent than broad red.

As in the case of the early red clovers, the British strains of late-flowering red are decidedly better than any of the foreign late reds. For three-year and possibly four-year leys a good ordinary strain of English late-flowering red is generally to be recommended, but for longer leys and for permanent pastures preference should be given to the extra late Montgomeryshire and Cornish marl types. These latter strains are also applicable to three- and four-year leys in many districts. Of the foreign strains of late-flowering red some of those from Canada have given good results in this country for longer leys.

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* See Leaflets 46 (*Stem Eelworm*) and 271 (*Clover Stem-Rot*) also Plant Breeding Work at Aberystwyth, this *Journal*, Oct. and Nov., 1920; and Jour. R.A.S.E., Vol 79, pp. 68-88.

The American Mammoth, although capable of giving very heavy yields of hay in the first harvest year, has, in Wales at all events, not proved to be long-persisting, and, except perhaps under particularly favourable conditions, has a too restricted growing season to be recommended for inclusion in a long-duration general purpose mixture.

Denmark and certain parts of Sweden produce fairly persistent late red clovers, but clovers from north Sweden and Norway have too brief a growing season to be grown economically in this country. There is insufficient evidence as to wild red clover to warrant one to recommend its inclusion even in permanent mixtures—most of the genuine strains of unimproved wild red clover appear to be very poor yielders, and some at least are certainly not long-persisting plants.

Seeding and Early Management of Young Clover Leys.—If the soils contain sufficient lime, satisfactory stands of red clover may be obtained on nearly all types of soil, except sandy, peaty and water-logged soils, but if the land is sour the clover will die back in a comparatively short time. All soils deficient in lime should, therefore, receive a dressing of lime before red clover is sown either alone or in mixtures.

The seed may be sown any time from the middle of March to the end of July. It is usually sown during April with a cereal nurse crop. If sown under winter wheat, the ground should be thoroughly harrowed in spring before sowing, and when the surface soil is dry the seed is sown, then completely harrowed in by means of a light peg-harrow, and rolled.

Special care should be taken in selecting a suitable variety as a nurse crop. Preference should be given to early or medium varieties which tiller sparingly and have a stiff straw of good standing ability, for instance, Yielder, Record, and Victory as oat nurse crops, and Goldthorpe and Standwell as barley varieties. A mixture of oats and wheat, on account of its greater standing ability, has been used as a nurse crop with very good results in certain districts.

A clean, firm seed bed of moderately good tilth is necessary for a good take. In districts of low rainfall efforts should be made to conserve as much moisture as possible in the soil.

The seeds are sown broadcast, either by hand or by a seed-barrow, or drilled by means of a corn drill. If drilled it should not be covered to a depth of more than one inch, but the best depth for covering red clover seeds is three-eighths of an inch to one-half inch. (See this *Journal*, Vol. XXIX, pp. 53, 132, 1125.)

Good takes depend, to a very large extent, on the thoroughness with which the seeds are covered. Since it is not possible to cover the seeds properly when the soil is wet, it is of the utmost importance that the surface soil should be perfectly dry when the seeds are sown broadcast. They should then be thoroughly harrowed in by means of a light peg-harrow or a chain-harrow; these have been found to give better results than the horse hay-rake and the Cambridge roller. The practice of covering clover seeds with the smooth roller alone is not recommended, as very many seeds are left uncovered. The covering implement should always be followed by the roller in order to consolidate the soil. If the soil is inclined to be loose and spongy a Cambridge roller should be employed.

It is advisable when cutting the nurse crop to set the binder knives fairly high so as to avoid serious injury to the young plants.

Red clover seems to respond more readily to applications of phosphate manures and farmyard manure than most crops. If these manures were not supplied to the nurse crop, it will be found a paying proposition to give the young " seeds " a dressing of about 5 cwt. of basic slag or 10 to 15 tons of farm-yard manure during the first autumn. On certain classes of soil it is also necessary to apply an adequate dressing of a suitable potash fertiliser, in order to ensure a good clover stand.

The grazing should be carefully regulated during the first autumn and winter. Red clover should not be allowed to become " winter proud " but, on the other hand, it should not be too closely grazed.

It is not advisable to continue the grazing late into the spring if the clover is intended for hay. Fields which are put up for hay not later than the end of February will, as a rule, give the heaviest crop.

The hay crop should be cut early before the clover attains the stage of full bloom. Not only will the quality of the fodder greatly diminish but the persisting powers will be seriously impaired if red clover is permitted to run to seed.

POSITION AND PROSPECTS OF EX-SERVICE SMALL HOLDERS.

ON the 18th December, 1918, the Government started its scheme for the settlement of ex-Service men on small holdings, and in approximately four years between that date and the 15th January, 1923, 18,960 applicants have been provided with holdings in England and Wales covering a total area of 268,407 acres. All of these, with comparatively few exceptions, are ex-Service men. At the request of the Council of Agriculture for England, the Ministry has recently prepared a report,* based on inquiries by its District Commissioners, as to the general position of these ex-Service holders.

The report contains, in the first place, a summary of the changes which were made by the Land Settlement (Facilities) Act, 1919, in the conditions under which small holdings were provided. The most important of these was that while before the war County Councils were only authorised to acquire land for which they could obtain rents sufficient to cover all outgoings, under the new Act the Councils are not restricted in this way and the Ministry defrays all necessary and reasonable loss incurred. Owing to the rise in the rate of interest which the local authorities must pay on money borrowed for the purchase of the land and the erection of cottages, farm buildings, etc., and to the greatly increased cost of building, it would not have been possible to settle the men without incurring financial loss. The Act provides, however, that such loss shall fall on the Exchequer and not on local rates.

Agricultural Conditions in 1921 and 1922.—Of the 18,960 men settled, about 11,000 have taken occupation of their holdings since the harvest of 1920. Consequently less than 8,000 have derived any benefit from the high prices which were realised for the produce of the 1919 and 1920 harvests. Between Michaelmas, 1920, and the end of 1921 the number who entered into occupation was 7,000. During this period the cost of ingoing was at its highest. Tenant right valuations were made on the highest basis known in this country for generations. Cattle, horses and implements purchased by small holders were also very expensive. Unfortunately, the drought of 1921 had disastrous results over a large part of England and Wales resulting in a scarcity of summer grass in stock-raising and dairying districts and a small yield of corn on the lighter lands, especially in the East of England. Among growers of wheat and oats, the unfavourable conditions were to some extent relieved by the receipt of the Government Corn Subsidy in January. 1922. But market gardeners who, in many parts of the country, had suffered most severely from the weather conditions received no share of the subsidy. Conditions in 1922, although different from those which obtained in 1921, were no better. The drought in the spring, followed by the unprecedented fall in the value of agricultural produce and stock. produced conditions at the end of the year which caused all occupiers of agricultural land the most serious anxiety. The reduced purchasing power of the public generally has not only had the effect of reducing the price of market garden and special crops, but also makes it extremely difficult at times for growers to effect sales at any price.

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* Obtainable from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. Price 6½d., post free.

The agricultural depression has unquestionably affected the ex-Service small holders no less than other farmers. Few, if any, have succeeded in getting through their first two or three years on the land without losing money, and no amount of industry, knowledge and experience could have prevented them from suffering a serious depletion of capital.

Proportion of "Casualties."—In spite, however, of the fact that circumstances have been wholly adverse, the proportion of actual failures among the men settled since the beginning of 1919 has been surprisingly small. The number of failures, *i.e.*, the number who have left their holdings after deducting those who have died or left for personal reasons, amounts to only 1,226 from the Armistice to Lady Day, 1923. During that period, as already stated, the number of men provided with holdings was 18,960, so that the failures may be regarded as 6·5 per cent. for the whole period.

It is interesting to compare these figures with the corresponding figures as to the number of failures among the statutory small holders who were placed on the land by Councils during the period 1908-14. During these years some 14,000 men were provided with holdings and less than 1 per cent. per annum failed, or rather more than 4 per cent. in seven years. This result was obtained on a rising market when conditions were, speaking generally, favourable to the development of the small holding movement. Having regard to the adverse conditions which have prevailed since 1920, the failure of 6·5 per cent. of ex-Service small holders in about three years can scarcely be regarded as unsatisfactory.

Among the factors accountable for this small wastage chief place must be given to the admirable "grit," thrift, and energy displayed by the majority of the small holders themselves. It should also be remembered that, as compared with other occupiers of agricultural land, a small holder has an advantage in that he seldom has to pay away much in wages, the work of his holding being performed principally by himself and his family.

Abatement of Rent and Provision of Credit.—The principal means which have been used by local authorities to assist small holders to carry on during recent adverse seasons have been the abatement of rent and provision of credit. As soon as it became apparent that a "slump" in prices had arrived, a demand for a reduction in rents arose in various parts of the country. The Ministry was not prepared to agree to Councils reducing permanently rents at Michaelmas, 1921, and Lady Day, 1922, as it seemed at those dates impossible to foresee what the future course of agricultural prices might be, and there was consequently no satisfactory basis on which to revise rents. On the other hand, the Ministry approved of Councils making substantial temporary abatements in suitable cases so as to meet the exceptional difficulties in which small holders found themselves. Since Michaelmas, 1922, rents have been permanently reduced in many districts. The circumstances, however, vary from county to county, and applications have been dealt with on their merits. The extent to which relief has been given by abating rent may be gauged by the fact that, taking the country as a whole, nearly 20 per cent. of the aggregate half-years' rent roll on the post-war estate was remitted at Michaelmas, 1922. Other remissions were made at Michaelmas, 1921, Lady Day, 1922, and Lady Day, 1923.

Councils have also in suitable cases assisted their tenants to overcome difficulties due to shortage of capital by giving them time in which to pay tenant right valuation, and also by guaranteeing advances from the banks under Section 18 of the Act. The tenant-right in arrears at one time amounted in England and Wales to about £70,000, which is being rapidly reduced by instalments. Similarly, the amount of loans guaranteed by Councils in favour of their tenants is over £150,000. These are, however, methods which need to be very carefully watched by local authorities. While credit often proves invaluable to an energetic and enterprising small holder, the necessity for the regular payment of interest or arrears of debt frequently proves a burden which a less successful man is unable to bear.

Future Prospects.—The number of actual failures can be ascertained by statistical returns, but it is more difficult to state what are the future prospects of the ex-Service small holders. That involves a venture into the realms of prophecy. Difficult as it is, however, to foresee the future, one statement can be made without any qualification, namely, that if the 1923 season proves as bad as either 1921 or 1922, and agricultural prices continue as unremunerative, the number of failures is certain to show a serious increase.

An ex-Service man who entered into the occupation of his holding in 1919 or 1920 with a capital of £500 has probably less than £300 left to-day. Everything that he bought then has fallen in value by at least 40 per cent., and the seasons have been such that he has been scarcely able to live from his holding let alone save money. Consequently he is inevitably in a weak position, and another bad year will materially reduce or even destroy his chances of pulling through. On the other hand, the evidence shows that practically all over the country the abatement of rent and other concessions which have been granted have been greatly appreciated by the ex-Service men, and they, with a few exceptions, are determined to make a success of their enterprise.

Taking the scheme as a whole, and having regard to the extremely unfavourable conditions which have prevailed in the last two years, the general conclusions arrived at are:—

(*a*) that the proportion of actual failures is surprisingly small: up to Lady Day, 1923, the total number of tenants who had left their holdings for financial or similar reasons was 1,226 out of the 18,960 provided with holdings since the Armistice, or 6·5 per cent.;

(*b*) that the extent to which the number of "casualties" is increased in the near future will depend primarily on the character of the next season or two and the future course of agricultural prices;

(*c*) that, in the event of the present season proving as bad as either the 1921 or 1922 seasons, the number of failures might be considerably increased; on the other hand, if the general conditions of agriculture improve in the next year or two there is no reason why the great majority of ex-Service settlers should not succeed in their enterprise;

(*d*) that, while failures attract attention, the most striking fact at the present time is the large proportion of ex-Service men who are cultivating their holdings well and increasing their head of stock;

(e) that, generally speaking, the "morale" of the settlers is good and rents are being paid satisfactorily.

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COUNCIL OF AGRICULTURE FOR ENGLAND.

THE Council of Agriculture for England held its Tenth Meeting on Thursday, 10th May, 1923, at the Middlesex Guildhall, Westminster. and, in the first place, unanimously elected Sir Douglas Newton, K.B.E., M.P., to be Chairman for the year 1923.

Statement by the Minister.—The Minister of Agriculture made a statement in continuation of that made by him before the December meeting of the Council. He referred especially to proposals which had been, or were to be, brought forword in the present Session of Parliament. In regard to railway rates, he pointed out that, as a result of the action of the Agricultural Committee of the House of Commons, an average reduction of one-seventh had been obtained in railway rates on agricultural products, which amounted to about 2½ million pounds. The beer duty had been reduced, which assisted the grower of barley, and the cider duty had been abolished. In connection with the establishment of co-operative milk-collecting depots and cheese factories, as recommended by the Agricultural Tribunal, he drew attention to the provisions of the Trade Facilities Act, by which loans of £5,000 and upwards could be made for such purposes on advantageous terms. For smaller schemes loans would be obtainable direct from the Ministry of Agriculture on similar terms. The remission of the duty on sugar manufactured from English sugar beet would still continue; he was glad to say that the sugar beet industry was really going ahead and flourishing.

The Agricultural Credits Bill would shortly be introduced. The delay in this matter was mainly the result of the criticisms which had been brought forward, but it had been useful delay, inasmuch as it would be found that the annual payments for interest and sinking fund for long term mortgage credits as suggested by the Bill would be about 1 per cent. less than the £6 8s. 3d. suggested in the Credits Committee's Report. A Bill would also be introduced laying an excise duty upon imported malting barley. This duty would not affect the price of beer. The Merchandise Marks Bill, which had been introduced in the House of Commons by a private Member, had reached a second reading and was receiving his support.

Turning to the question of Agricultural Rates, the Minister said that it had been arranged that a sum of at least 1¼ millions would be granted from the Road Fund towards the upkeep and improvement of rural district roads. The whole question of rating would, however, be dealt with in a Bill which the Government proposed to bring in during another Session, though. in the meantime, it had decided to bring in a smaller Bill in the present Session, to reduce the assessments on agricultural land from one half to one quarter of the annual value and to make good the deficiency out of public funds. This would benefit occupiers of land in England and Wales to the extent probably of 2¾ millions.

In regard to agricultural wages, the Government proposed to introduce legislation for the compulsory registration of wages agreements arrived at by Conciliation Committees.

In conclusion, the Minister said that it was not going to be an easy matter to get these Bills through Parliament, and if agriculturists took up the attitude of saying "After all, these Bills are not very much good to us—we want something more," the difficulties would be very much increased. If all the measures were got through this Session, it would constitute a fairly big thing for agriculture. He asked the Council to help the Government all it could to carry through its agricultural programme, not as everything that could be done, but as being as much as it was possible to do within the present year.

In reply to questions, the Minister said that the question of laying an excise duty on malting barley substitutes, as well as on malting barley, was now under consideration by the Government, that he saw no cause for any suspicion that the rates that were taken off agricultural land would be put upon farm buildings; and that the annual payments from the Exchequer to make good the amount remitted from agricultural rates would vary each year and not be fixed as in the 1896 Act; and that it was proposed to extend the maximum period for long term loans under the Agricultural Credits Bill to 60 years.

Sir Merrik Burrell proposed, and *Mr. Hamilton* seconded, a very hearty vote of thanks to the Minister of Agriculture for his statement. *Mr. Dallas* proposed an amendment to the effect that, having heard the Minister's statement, the Council deeply regretted that the Government intended to do nothing whatever for the agricultural worker. The amendment was, however, not seconded, and the original motion was carried.

The Minister, in reply, thanked the Council and said, with regard to Mr. Dallas's proposed amendment, that it was the deliberate opinion of the Government that the prosperity of the agricultural labourer would be promoted by giving help to agriculture.

Canadian Cattle for Breeding Purposes.—Lord Strachie moved :—" That this Council is opposed to the proposed admission of cattle from Canada for breeding purposes." He called attention to similar resolutions which had been passed by the principal Breed Societies, as well as by the Agricultural Advisory Committee. In moving this resolution he was doing so on behalf of all breeders and agriculturists in England and Wales. It was remarkable that the Minister was unable to take the advice of his Advisory Committee in this matter, and had announced that he saw no alternative except to proceed with the Order. His Lordship recounted the recent history of the Canadian cattle question and stated the present position under the Importation of Animals Act. The recent pledge in regard to breeding cattle had been given by the late Minister of Agriculture in the late Parliament, and the present Government should be at liberty as regards a domestic affair such as this to reverse the decision of a previous Government or Minister. In any case, the Order, which alone could be the subject of a pledge, could be thrown out by the presentation of an Address by either House of Parliament. Mr. German seconded the motion, which, after further discussion—in the course of which the Minister gave his reasons for considering that the Government held itself bound to lay an Order, and in which Mr. Owles, Mr. Nicholls, Lord Bledisloe Sir Merrik Burrell, and Mr. Donaldson joined—the motion was put to the meeting and carried unanimously

Industrial Interest in Agriculture.—Mr. W. S. Royce. M.P., moved : —" That it is necessary to stimulate on the part of the urban and industrial communities greater interest in the development of agricultural England." The mover called attention to the fact that during periods of agricultural depression the wages of the workers on the land were reduced so low that many labourers were forced out of their employment and migrated to the towns or to the Colonies. In the towns, they frequently depressed labour conditions, and bringing with them feelings against employers in the country created other feelings between urban and rural communities which was certainly not of goodwill. Labour were showing signs of a better understanding of the situation, but that was not the case with Agriculture. Combinations of traders were exerting themselves to obtain the highest possible prices for the articles which agriculturists produced. This was detrimental to the interests of agriculture.

The motion was seconded by Lord Bledisloe, who suggested three ways in which to stimulate the interest of urban population in agricultural conditions. Firstly, the three organised sections of the agricultural community, the land-owners, the farmers and the labourers, should do all in their power to enlighten the townspeople in regard to agricultural difficulties, because of the importance to the latter of a sound agricultural policy. Secondly, there was the Press, and thirdly, the Government. The Press had been very useful and active in the direction indicated during the last few months. Speakers of the Government might also take suitable opportunities of emphasising the enormous importance of agricultural prosperity to the industrial centres.

The motion was further discussed by Alderman Bellwood, Mr. Cross, Mr. Haman Porter, put to the meeting and carried. Mr. Royce proposed, and Col. Courthope seconded, the suggestion that the motion be referred to the Agricultural Advisory Committee as to what steps could be taken to give effect to the resolution. The Council agreed with the suggestion.

Cleansing of Ditches and Watercourses.—Alderman S. V. Hotchkin moved : "That the attention of the Ministry of Agriculture be called to the urgent need of adequate powers being given to County Agricultural Committees to assist, and if necessary to compel, owners, occupiers, and Drainage Authorities, who are neglecting their duties, to clean out ditches and watercourses."

He referred to the fact that owing to the repeal of Part IV of the Corn Production Act, the County Agricultural Committees were placed in a very difficult position, and had not power to deal with many cases of drainage neglect which they felt ought to be dealt with. There were certain areas which had no Drainage Authority in control and there were also small areas where the Drainage Authorities were unwilling or unable on account of the expense to carry out necessary drainage work. The County Committees should have power to deal with these matters, and to bring pressure to bear on individual owners who deliberately neglect their duty of cleaning out ditches to the great detriment of their neighbours' land. Where there was no Drainage Authority, he suggested that the Ministry should be empowered to advance money to individuals to get drainage works of urgency carried out. The motion was seconded by Mr. Bellwood, and discussed by Mr. R. L. Walker, Mr. McCracken and Mr. Fitzherbert Brockholes, put to the meeting and carried.

Importation of Foreign Potatoes.—Alderman H. P. Carter, O.B.E., moved: "That the Government be urged to take steps to avoid disaster to the potato industry of the country by accepting the recommendations of the Tribunal of Eonomists and by introducing legislation to prohibit the importation of foreign potatoes, except under licence, when the crop in this country is deficient or defective."

He stated that potato growers had suffered unprecedented loss on last season's crops. He computed it at no less than 8½ million pounds. Smallholders and ex-Service men were in many cases very hardly hit and County Councils had been compelled to reduce rents to meet the losses sustained. It was very unfair that foreign potatoes should be dumped in this country at a time of our own over-production. Mr. Hotchkin seconded this motion and the debate was continued by Mr. Cross, Mr. Gardner, Mr. Langford, Mr. Patterson, Major Fawkes, and Mr. German. Mr. Clement Smith moved an amendment that all words after "country" (on second line) be omitted. Major Fawkes seconded it, and the amendment was put to the meeting and carried by 21 votes to 16. The amendment was then put as a substantive motion and carried. Mr. Carter suggested that this resolution also be referred to the Agricultural Advisory Committee. His suggestion was seconded by Mr. Fitzherbert Brockholes and agreed to by the Council.

Protection of the Plover.—Mr. A. R. White proposed and Major F. H. Fawkes seconded the following resolution which was put to the meeting and carried:—

"That, having regard to the greatly diminished number of lapwings or common plovers (birds which do an enormous amount of good by the destruction of injurious insects in the soil), this Council begs to call the attention of the Ministry of Agriculture to the desirability of their greater protection and preservation."

Position and Prospects of Ex-Service Men.—The Report on the present position and future prospects of ex-Service men settled on the land in England and Wales which had been laid before the Council was then considered. Mr. Denton Woodhead asked for information on two points. First, as to whether any women were working on smallholdings in the country, and if so with what success. Second, that information be forthcoming as to the cost of local and central administration which was absent from the Report. He formally moved that the Report be received. Mr. Hamilton seconded the motion, and pointed out that the percentage of men who had failed was very few indeed and was due, in his opinion, at any rate in Lancashire, to the fact that the County Land Agent was very careful in the selection of men as smallholders. Mr. Nicholls inquired whether the Ministry insisted in the case of Peterborough in their objection to a permanent reduction in rents being made whilst such reductions were being sanctioned in other districts. The position now was that the better the smallholders did, the less likely they were to get their rents put down to an economic basis. Mr. Patterson inquired what period the Report covered. In his county a large number of smallholders were in difficulties. If an abatement of the whole of their rental were given them it would not enable them to carry on. A report of the position in twelve months' time might disclose a very different state of affairs from that set forth in the Report. Mr. German said that the Report read as that of an optimist. He, like Mr. Patterson, did not think that the Report should go forward as a fair example of the present condition of affairs. Alderman Quinney challenged Mr. German's statement, and after further discussion Mr. German moved that the Report be referred back to the Ministry with a request for the Ministry to prepare a Report for the Council giving particulars as to outstanding rents, the amount of loans advanced and repaid, and the amount of valuations outstanding on Lady Day last. Mr. Colin Campbell seconded this amendment. Ex-Service smallholders could not, he said, have started farming at a worse time, and those who had survived had lived through two most difficult years: only 6 per cent. had failed. Mr. Woodhead and Mr. Nicholls spoke on the amendment and agreed to ask for further particulars but did not wish to hold back the Report. Mr. German then expressed his willingness to withdraw the amendment, and the motion that the Report be received by the Council was carried. Sir Francis Floud stated that the figures in the Report were those up to Lady Day, 1923, they gave the numbers of men who had actually failed and left their holdings up to that date. The Report was a statement of the facts as received from the County Councils. If prices remained as unremunerative as they had been for the last two years the number of failures would be largely increased. The Ministry would be glad to get the further information asked for in the course of the debate and would get it for the same period as the Report covered, *i.e.*, up to Lady Day last. The figures would be ready for the next meeting of the Council.

Report of Agricultural Advisory Committee.—The Half-Yearly Report (No. 5) to the Councils of Agriculture for England and Wales of the Proceedings of the Agricultural Advisory Committee was, on the motion of Mr. E. W. Langford, received by the Council. (The Report is printed below.)

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AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

THE following is the half-yearly report (No. 5) to the Councils of Agriculture for England and Wales, on the proceedings of the Agricultural Advisory Committee:—

Since the last half-yearly report, dated 30th November, 1922, was issued,* the Agricultural Advisory Committee has had five meetings, viz.: on 6th December, 7th February, 7th March, 18th April, and 2nd May, at which the following subjects have been under discussion:—

(1) **The Admission of Breeding Stock from Canada.**—The Minister stated at the meeting on the 6th December, when the subject was referred to in connection with the Importation of Animals Bill which was then about to be introduced into the House of Commons, that the Canadian Government had definitely undertaken to admit breeding cattle from this country on the same terms as cattle from Canada were admitted into Great Britain, that any Order of the Ministry laying down terms of admission of Canadian breeding stock under the Bill would be required to be laid upon the table of both Houses, and that if an Address against the Order was decided upon by either House, the Order would not become operative. At the next meeting of the Committee, a draft of the proposed Order was circulated, and it was considered that the Ministry should ask the various Breed Societies as to their views upon the Order itself, and also as to whether a clause should be inserted requiring animals to be tested for abortion disease. At the same meeting, however, the Committee unanimously passed the following Resolution:—"That the Agricultural Advisory Committee recommends that no action be taken under Section (2) of the Importation of Animals Act, 1922, until experience had been obtained as to the working of Section (1)." It was at the same time agreed that if the Government found it impracticable to

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* See this *Journal*, January, 1923, p. 925.

adopt this advice, the Breed Societies should be consulted as had been at first suggested.

At the following meeting on the 7th March, the Minister informed the Committee that the Government had decided that the proposed Order for the admission of breeding animals from Canada should proceed, and that the Ministry were therefore acting upon the alternative advice given by the Committee to refer the draft Order to the Breed Societies for their views in the first instance. At the next meeting on the 18th April, the Minister informed the Committee that the Breed Societies practically unanimously opposed the Order, but he saw no alternative in the circumstances to placing an Order before Parliament, and he invited the Committee to consider what provisions should be suggested so as to restrict the Order to the best classes of breeding stock only. The Committee, however, decided that the only course they could rightly and logically adopt was to stand by the resolution stated above and decline to agree to the importation of breeding cattle at all.

(2) **The Admission of Store Stock from Canada.**—Early copies of the Importation of Animals Bill were placed in the hands of the Committee at their meeting on the 6th December and the proposed provisions were discussed. It was made quite clear that the Committee could not be responsible for the terms of the Bill, which had been based upon a Conference at which the late Minister of Agriculture had presided over a month previously.

(3) **The Grant of £850,000 for Agricultural Education and Research.**—A statement showing the position of the Schemes so far agreed upon was laid before the meeting on the 6th December. The Minister informed the Committee that the Treasury had agreed to the view that the money should be additional to the State grants which were annually being spent on agricultural education and research, and that the Fund with interest should be utilised over a period of 5 years ending 31st March, 1927. New schemes started out of the money would be maintained after that date by further State funds where necessary, though the Ministry had been requested to reduce this contingent cost for maintenance to the lowest possible amount. The statement which was submitted to the Committee showed that the total of the expenditure so far agreed upon from the Fund stood at £706,885 with a probable annual recurring expenditure after 1927 of £108,000.

The special points decided by the Committee in the period under review in connection with this grant were the following :—(1) That the Ministry should consider again the question of requiring personal guarantees from the governors of agricultural institutions that a definite proportion of the expenses of an approved undertaking should be raised by voluntary contributions by a certain date as a condition of the payment of grants from the Fund. (2) The allocation for animal disease research and education. The main grant was made to Cambridge for the establishment there of an Institute and Professorship for the subject. A suitable grant was also agreed upon for the Royal Veterinary College at Camden Town. (3) The proposal to add a new dairy to the Rodbaston Farm Institute at an approximate cost of £3,000, of which £2,250 was proposed to be met by a grant from the Fund, was considered and approved. (4) It was agreed that a grant of from £3,500 to £4,000 per annum for four years should be made to the Campden Experimental Fruit Factory. (5) It was agreed that assistance should be given to a proposal to introduce merino sheep from the hill country of Peru for the improvement of British wool. The sheep were a gift and their importation would only be sanctioned under careful restrictions so far as the possibility of introducing disease was concerned. The aim of the Ministry in proposing assistance in the matter was to secure that the gift was made the best possible use of from the breeding point of view.

(4) **Standard Rates of Agricultural Wages in Certain Districts.**—The Committee decided at their meeting on 7th February that it is not advisable to hold public enquiries for the purpose of ascertaining standard rates of wages in those districts where no Conciliation Committee decision were in operation. The current rates could, it was thought, be supplied, if and when required, by the principal Unions of Farmers and Workers.

(5) **Hop Production.**—The Committee was informed at its meeting on the 7th February of the circumstances under which it was necessary to suggest a limitation of hop production this year.

(6) **Regulations under the Milk and Dairies Act.**—The Committee was informed that, in deference to the suggestion which had been made to the Ministry of Health by the National Farmers' Union on the subject of the lettering on condensed milk tins, that Ministry had agreed that a statement to the effect that condensed skimmed milk was unfit for infants' food should appear on tins containing that product, and that the lettering should be large and conspicuous.

(7) **Drainage Unemployment Relief.**—The Committee was informed that the monies available under this scheme could be applied in certain cases to pipe drainage work, as well as to the making of open ditches. The cases in which grants for pipe drainage might be approved were those which were "combined" schemes, *i.e.*, schemes dealing with more than one property in the occupation of more than one farmer.

(8) **Agricultural Credit Committee's Report.**—The Minister's attention was drawn to various points as a result of the Advisory Committee's consideration of this Report. The chief were that the rate of interest for long term loans was too high for loans to be of any real benefit to those farmers who need them ; that loans had been granted to farmers by the Banks up to 75 per cent. of present values, or 60 per cent. of the then value of the land a few years back when farms were being bought in consequence of the Government guarantee, and that the Banks would probably be prepared to make advances with a smaller margin than was suggested in the Committee's scheme, though not for an indefinite period ; that it was a mistake for the Government to treat agriculture as though it were an ordinary commercial undertaking, disregarding the fact that it was a National institution with a National value: that in order to put the Industry on its feet again the State must be prepared face to the risk of some loss, and in any case to give substantially better terms than the Banks ; that the ½ per cent. to be charged for expenses and profits of operating companies, and the ½ per cent. for a reserve fund for bad debts amounted to a considerable additional charge which was hardly justified in view of the onerous conditions, including a "trustee" valuation, required to be observed where long term credit was to be allowed. The Minister informed the Committee that their observations and criticisms would be borne in mind in connection with the preparation of the Bill which would be introduced into the House of Commons after Easter.

(9) **Fertilisers and Feeding Stuffs Act Amendment.**—This subject had come before the Council of Agriculture at its last meeting, when the question was considered of whether the Ministry's sanction to prosecutions proposed by Local Authorities should continue to be required. It was represented in Committee that this condition in the present Act had resulted in making the Act a dead letter in many districts. It was stated, however, that there had been conferences between farmers, traders, and merchants at which a considerable measure of agreement as to an equitable procedure for all concerned had been obtained. It was finally agreed that the Ministry should appoint a Committee to consider the various amendments proposed to this Act, including that in regard to the sanctioning of prosecutions.

(10) **The Interim Report of the Agricultural Tribunal of Investigation.**—At the meeting on the 2nd May, the Committee discussed with the Minister the decisions of the Government arising out of the consideration of this Report. The first decision of the Government was on the question of railway rates, viz: "The Government are of opinion that the Railway Companies are in a position to reduce rates drastically. The remedy, however, lies in the hands of the industry itself, which can make an application to the Railway Rates Tribunal established by Parliament for such cases. In this connection, meetings between the parties are being arranged and the Ministry of Agriculture has expressed its willingness to give any assistance in its power." The Committee generally approved this decision. It was represented that milk, the charges for which had not been reduced under the recent arrangement, ought to share in it. Incidentally, it was agreed that the charges for licences under the Milk (Special Designations) Order of the Ministry of Health should be reduced, if not abolished, as the Order was one made in the interest of public health and the charges did not assist the production of pure milk.

As to local rates, the Government had decided "That the Road Fund Surplus, amounting probably to over £1,250,000, should be devoted to the relief of rates for the upkeep of rural roads. The Government also intends, pending proposals for dealing with the whole rates question, to introduce a Bill this session to reduce the assessment of agricultural land from one-half to one-quarter, making good the difference by an Exchequer grant. This would be in addition to the proposal as to the Road Fund." The situation was explained in detail to the Committee, which was informed that the concession would be retrospective till 1st April last, and that the Exchequer grant would be a variable one each year so as to make up the whole of the deficiencies in that year.

In regard to wheat offals, the Committee was informed that the Government did not accept the proposals of the Tribunal. The Minister discussed with the Committee the difficulties in the way of accepting the proposals.

In regard to malting barley, the decision was that "the Government accept the proposal that an Excise Duty at the rate of 10s. a quarter be imposed on imported malting barley, to be collected at the brewery, distillery or malthouse, with a preference of one-third on barley imported from the Dominions. It was part of the arrangement concluded with the brewing industry before the introduction of the Budget that this should not involve any rise in the price of beer. The Government propose to introduce a Bill dealing with the matter in the course of the present Session." The question of the possibility of a tax upon substitutes was raised in the Committee, and the Minister promised to give this point further consideration.

In regard to hops, the Committee were informed that "The Government do not adopt the recommendations of the Tribunal. A little time will be necessary to ascertain what will be the probable future consumption of beer. The present Control will continue to 1925. The Government recognises the claims of the hop-growers and before the expiration of the Control will deal with the question." The Committee expressed agreement with this decision.

The decision arrived at in regard to potatoes was that "The Government are not at present prepared to adopt the proposal of the Tribunal that imports of foreign potatoes be permitted only under general licence of the President of the Board of Trade." The Minister explained to the Committee that in 1922 the total importation of potatoes was not larger than 4 per cent. of the whole supply, and that 1922 was altogether an abnormal year as regards the home crop. He stated, however, that the Government were ready to consider the situation again next session.

As regards Milk Production, it was stated that "The Government are in favour of the proposals made in paragraph 33 (erection of milk collecting depots, etc.) of the Report, and are considering how the proposed assistance can best be given." The Committee were informed that the Trade Facilities Committee were quite prepared to give financial assistance to agricultural undertakings such as the erection of milk collecting depots, bacon factories and so on, in the same way as they gave facilities in other industries. One-third of the capital required for building and equipment could usually be obtained at 5½ per cent. for 20 years, provided that the loan required was not less than £5,000. The Ministry were endeavouring to obtain from the Treasury additional facilities to assist the smaller cases, *e.g.*, the erection of cheese factories.

In regard to Wages, it was announced that "The Government are not prepared to adopt the proposal for setting up six District Wages Boards. They intend, however, to introduce legislation to make compulsory the registration of agreements arrived at by Conciliation Committees." As a result of the Committee's discussion, the Minister promised to see the representatives of Labour and the Farmers upon it if they wished.

In addition, the proposed facilities under the Agricultural Credits Bill which was shortly to be introduced were briefly indicated. The recommendations which the Advisory Committee had made at an earlier stage had been taken into careful account in drawing up a Bill. There was a prospect of the rate of interest for long term credit in respect of farms which had been bought at the time of the Government guarantees being reduced.

(11) **The Reports of the Proceedings of the Various Advisory and Departmental Committees set up by the Ministry.**—Two Reports have been received by the Committee under this head in the period under review. Arising out of a discussion on the proceedings of the Electro Culture Committee, the Chief Scientific Adviser to the Ministry stated that the results of the experiments made by the Committee during the last year or two appeared to be trustworthy and to put the question of whether aid could be

given to growth by electricity beyond doubt; whether there could be any practical application of the results, was, however, still to be proved.

It is with much regret that the Committee have to report to the Council the heavy loss which they have sustained through the death of Mr. David Ferrie, of Parbroath, Cupar. Mr. Ferrie was an original member of the Advisory Committee and had rendered valuable services to British Agriculture, most recently as a member of the Foot-and-Mouth Disease Committee. The Agricultural Advisory Committee passed a vote of condolence with Mr. Ferrie's family and instructed that a suitable letter conveying it should be sent to Mrs. Ferrie. His place on the Committee has been filled by the nomination of Mr. John McCaig, of Belmont, Stranraer, by the Secretary for Scotland.

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SOFT OILY BACON—ITS CAUSE AND PREVENTION.

F. W. JACKSON, B.Sc.

THE lack of uniformity in bacon pigs is one of the chief handicaps of the curer. Variations in the quality of the fat are frequently exhibited, and heavy pecuniary loss is incurred during the disposal of the affected bacon and hams. In addition, the curer's reputation may suffer through no fault of his own.

Soft fat is detrimental to bacon and hams not only on account of wastage when cooking, but also because such fat develops rancidity more rapidly than firm fat. Moreover, the appearance of the bacon leaves much to be desired.

Unfortunately, there is no certain test by which the curer can forecast the nature of the bacon-fat from an inspection of the freshly-killed carcass. Consequently, it is not possible to pick out the defective sides and hams until curing has been completed.

The curer's aim is to trace the *cause* of soft bacon, in order to abolish it. The following pages indicate that soft fat appears to be the result of a form of mal-nutrition, which usually consists in the diet being over rich in oil.

Nature of Soft Bacon Fat.—Whereas pale dry mild-cured bacon and hams possess fat which is firm, white and non-greasy to the touch, the soft bacon which is the subject of this article seems to lack any coherence, and is distinctly oily. In colour it may be pure white, but it is more often yellow, there being many gradations and tints of the latter colour. The soft fat is usually subject to rancid changes, which have full play during the maturing process.

A comparison of the properties of these types of bacon-fat enables one to come to a remarkable conclusion, which gives a clue to the origin of the soft varieties.

Soft fat is firm normal fat mixed with oil: that is to say, pigs yielding soft fat have produced normal fat in the usual way, but have mixed with it concurrently a certain amount of oil. The bacon-fat derived therefrom resembles, in its properties, a mixture of normal firm bacon fat with a foreign oil. There is a large amount of evidence to show that the oil forming the adulteration has been derived from the pig's food.

The Practical Origin of Defective Bacon Fat.—Curers are usually able to refer back to the feeder, in cases where pigs have furnished defective fat. It has therefore been possible to deduce that defects in the fat are associated with certain foods. Warnings against the excessive use of such foods have occasionally appeared in the Press,* but so far as is known, no attempt has hitherto been made to arrange such foods in order of relative potency.

One general characteristic possessed by the objectionable foods is apparently a high content of oil. Two aspects of the subject demand attention in consequence:

(1) Why should a high content of oil in the diet tend to modify the normal quality of the pig-fat?

(2) Have all oils the same effect as regards both the magnitude and nature of the softness produced?

Feeding Excess of Oil to Pigs.—Normally, the pig manufactures its body-fat from starch, and such manufactured fat is presumed to be of maximum firmness and whiteness. If the starch-supply happens to be low, and oil takes the place of starch in the diet, it is reasonable to suppose that the amount of fat manufactured from starch suffers a reduction, and that any excess of oil in the food is used to make good the shortage of manufactured fat.

On the other hand, it is possible that, when the starch supply is excessive, the pig will use starch instead of oil for energy-production, and in this case the *whole* of the oil in the food is liable to be transferred to the fat cells without constitutional change. External conditions too, such as excessive cold or damp may influence the pig to store up every scrap of oil which he can extract from his food.

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* See E. T. Halnan, this *Journal*, Vol. XXVIII, 1921, Oct., p. 668, and "Feeds and Feeding" (Henry and Morrison), 1922, pp. 621, 679.

Nature of Effects Produced by Excess of Oil.—If defective pig-fat consists of natural fat mixed with an excess of oil derived from food, the amount of the resulting deviations in character from normal must depend on the properties of the oil concerned.

Most of the oils found in pig-foods are noted for their greater or less thirst for oxygen, and might be classified accordingly. Combination with oxygen promotes rancidity with its accompanying flavours and odours. A special form of rancidity is that shown by the "drying" oils which, in combining with oxygen, change colour to yellow, and produce a varnish-like film over the exposed surface.

It appears probable, though not actually proved, that soft yellow bacon owes its distinctive colour to the existence of a drying or semi-drying oil in the fat. It is important therefore to mention the "drying" property of feeding-stuff oils. This is indicated in Table I. The drying capacity of an oil, however, cannot be expressed numerically, nor does it necessarily indicate the power of the oil for producing soft bacon fat. Some arithmetical method of expressing "softening power" is obviously desirable, in order to arrange the feeding-stuff oils accordingly. Chemical data, which cannot be touched upon here, will enable us to do this.

Softening Power of Oils.—Owing to fundamental differences in composition the actual softening power of feeding-stuff oils varies between considerable limits, as indicated in Table I. This table shows the softening powers expressed in figures, calculated from the chemical properties of the oils. The best way to explain "softening power" is to define it as "*the number of parts by weight of firm pig-fat which, if admixed with* 10 *parts of the oil in question, would furnish a*

TABLE I.

RELATIVE POWERS OF VARIOUS OILS FOR PRODUCTION OF SOFT PIG-FAT.

Oil.	*Softening Power.*	*Note.*
Linseed	60	D
Soya Bean	35	D
Maize	26	SD
Beech Nut	23	SD
Cottonseed	21	SD
Wheat	18	SD
Pea	18	?
Oat	15	?
Rice	14	ND
Peanut (groundnut)	12	ND
Barley	10	SD
Rye	6	SD
Bean	6	SD

NOTE.—D = Drying; SD = Semi-drying; ND = Non-drying oil.

blend having a standard degree of softness." For example, 10 parts of linseed oil mixed with 60 of firm pig-fat would produce a mixture equally as soft as a blend of 10 parts of rice oil with 14 of firm pig-fat. In other words the greater the softening power of an oil, the more pig-fat will be softened by a given weight of it.

Excess of Oil in a Food.—The next point to be mentioned is that the *quantity* of surplus oil is quite as important as its quality. In order to grade pig-foods relatively amongst themselves with respect to their softening power, it is therefore necessary to obtain the combined effect of quality and quantity by multiplying the *amount of oil available for softening*, by the *softening power* as taken from Table I.

What is the amount of oil in a food, which is available for softening? In default of any data to guide one, it is necessary to make an assumption or two. Any excess of oil above that required for energy-production, is available for softening. Unfortunately, there is not, as far as is known, any method of determining the amount of oil needed for energy-production. This is because the amount and nature of the other dietary constituents influence the pig in its choice of fuel. It appears possible that the richer the diet in starch, the more likely is the pig to use starch as its source of energy. In such a case the oil is liable to be transferred at once to the fat-cells.

Owing to the meagre state of our knowledge it is impossible to say what proportions must exist between the dietary units in order to minimise this possibility, but we can best guard against this direct transference of oil by having the oil-content of the diet as low as possible. Hence there is no maximum percentage of oil which is *safe;* any oil present is liable to appear in the pig-fat. The effect of the oil on the pig-fat is proportional to its softening power, and hence the best way of grading foods, when considering the possibility of their causing soft fat, is by multiplying the oil-content by the appropriate softening power, and comparing the products obtained. This has been done for various foods in Table II, the products being arranged in descending order under the heading "Softening Power of Food."

It only remains to explain how the oil-content of the food, as given in this table, is obtained. Obviously, for the amount of oil present we must use the "digestible" figure, which is given as a percentage on the actual food. Foods vary in dry matter, in total digestible matter, and in starch equivalent, and for the present it has been decided that foods can best be compared in oil-content by calculating the percentage of digestible oil on the basis of the starch-equivalent. This then is the figure used in Table II.

TABLE II.

TYPICAL FOODSTUFFS USED FOR PIGS.

RELATIVE CAPACITY, WEIGHT FOR WEIGHT, FOR PRODUCING SOFT FAT.

Foodstuffs	Digestible Oil per cent. on Starch Equivalent.	Softening Power of Oil	Softening Power of Food	Nutritive ratio 1 to
Linseed Cake, foreign ...	12·2	60	732	2
Soya Beans	20·0	35	700	2
Beech Mast	28·0	23	644	7
Cottonseed, Egypt	25·7	21	540	6
Maize Germ Meal	15·0	26	390	7
Peanuts, whole	30·7	12	368	4
Soya Bean Cake	9·3	35	326	1
Cotton Cake, decort. ...	13·2	21	277	1
Linseed Cake Meal	4·4	60	264	1
Hominy Chop, high grade ...	9·3	26	242	12
Rice Meal	16·0	14	224	9
Maize Germ Cake	8·5	26	221	5
Distillers' Grains, dry ...	17·8	10	178	3
Groundnut Cake, undec. ...	14·4	12	173	1
Maize Gluten Meal	5·4	26	140	2
Oatmeal, prepared	8·8	15	132	5
Brewers' Grains, fresh ...	13·0	10	130	3
Maize	4·8	26	125	11
Sharps	6·7	18	121	4
Pollards	6·7	18	121	5
Brewers' Grains, dried ...	11·6	10	116	4
Groundnut Cake, decort. ...	9·3	12	112	1
Wheat Bran	6·2	18	112	4
Oats	6·7	15	101	7
Maize Gluten Feed	3·6	26	93	3
Soya Bean Meal, extd. ...	2·2	35	77	1
Fine Middlings	4·2	18	76	5
Barley Bran	5·1	10	51	6
Barley Malt Culms	3·5	10	35	2
Wheat	1·7	18	31	7
Peas	1·5	18	27	3
Barley	1·7	10	17	10
Beans	1·8	6	11	2
Rye	1·5	6	9	7
Rice, polished	0·3	14	4	13
Palm Kernels, whole ...	32·4	—	—	16
Coconut Cake	12·1	—	—	4
Palm Kernel Cake, impd. ...	12·0	—	—	5
Coconut Cake Meal	8·8	—	—	4
Milk, Whey	3·3	—	—	9
Palm Kernel Meal, extd. ...	2·7	—	—	3
Blood Meal	1·3	—	—	—
Milk, Separated	1·2	—	—	2
Potatoes	—	—	—	16

Soft bacon fat arises from two causes, both of which must operate together: there must be excess of oil in the food, and the oil must have the power of softening firm pig-fat. In consequence two foods may be equally effective in causing softness if the larger excess of oil in the one food is balanced by the greater softening power of the oil in the other food.

Although Table II may require modification as our detailed knowledge of this subject widens, it appears to fit in with all the facts as at present known: and chiefly it provides a useful guide for pig-feeders by indicating how foods compare with regard to fat-softening.

The column of nutritive ratios has been included in order to indicate that many of the foods cannot in any case be employed alone. If the supplement, called for by an unbalanced food, be chosen from amongst those foods at or near the bottom of the list, the potential danger of causing softness is thereby automatically reduced.

In this connection, it can be realised how dangerous are such foods as maize germ meal and cake, and rice meal. These three foods have almost ideal nutritive ratios, and the unwary might use them as basic components of a diet. It is perhaps significant that maize germ products and rice meal appear to be amongst the most frequent constituents of diets causing soft oily bacon.

In default of more exact knowledge it is difficult to say where the safety-line can be drawn in this list of foods, but an upper limit of 50 units of softening power in the case of the food is suggested. Any food having a greater softening tendency must be blended with one having zero softening power and an appropriate nutritive ratio, so that the mixture has a softening power of not more than 50 units, and the less the better. The diet should contain only one "softening" food at any one time. In the case of nine foods which appear at the base of the table, it is not possible at present to calculate the softening power. The only criterion to apply is, therefore, the oil-content, and those which show the lowest figure should be preferred.

Note on Fish Meal.—The case of fish meal is somewhat peculiar. The oils contained in fish are exceptional because of their outstanding tendency to cause softness and rancidity. The writer believes that there is no real difference between "white" fish oils and other varieties in this respect. Moreover, rancid fish-oil is far more objectionable than rancid vegetable oil. Fish meal varies in composition but its softening power can be taken as 220 units.

This subject is a very controversial one. Whilst it is generally admitted that young pigs derive a considerable amount of benefit from the use of fish meal, the important question of the quantity to be fed, and the far more vital question—from the curer's standpoint—as to whether the use of this meal, in the early stages only of a pig's life, will communicate a taint to the cured hams and bacon, however long the subsequent period during which fish meal is withheld, can only be definitely determined by careful and exhaustive practical tests. It is believed that such tests will shortly be undertaken. Whatever may be the outcome of these experiments, the effect of the use of fish meal on the trade in home-cured bacon has been so disastrous that, at the present stage, the majority of bacon curers take up the firm attitude of discouraging its use entirely, as their losses in connection with this fishy bacon have been extremely heavy.

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HURDLE MAKING BY MACHINERY IN NORTH WALES.

COMMUNICATED BY THE RURAL INDUSTRIES INTELLIGENCE BUREAU.*

In giving the following brief account of hurdle manufacture as carried on at Lake Vyrnwy, on the estate of the Liverpool Corporation, the Bureau is indebted to Colonel J. H. Forrester Addie, C.B.E., the agent and manager of the estate, for his interest in rural industries and his kindness in arranging a visit to the estate.

Hurdle-making was started on the Lake Vyrnwy estate rather more than 12 months ago, as there was found to be available a large quantity of thinnings which were otherwise of little use or value. The place is not easy of access; ten miles of mountain road separate it from the nearest railway station, and the cost of transport makes timber grown there unmarketable.

The type of hurdle made is of a heavier kind than the usual cleft variety chiefly produced in England, and will make, in fact, a solid permanent fencing which cattle cannot break down.

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* Inquiries arising out of this article and applications for reprints should be made to the Secretary, Rural Industries Intelligence Bureau, 258/262, Westminster Bridge Road, London, S.E.1.

The sketches show a stock pattern 6 ft. by 4 ft. hurdle with 4 cross bars and also a standard 6 ft. by 3 ft. hurdle and gate. They are made in various sizes and with 4 to 6 cross bars as required.

The hurdles are chiefly of larch and Douglas fir thinnings used green, and, with the exception of fitting them together, they are almost entirely machine made. The posts are about 3 in. by 4 in. in section, and the cross bars are circular morticed into holes about 1⅛ in. or 1¼ in. diameter drilled in them. The projecting peg seen in the sketch is the means of securing one hurdle to another, and provides a very simple and effective means of obtaining a solid continuous fence.

Output and Costs.—Eight men are employed on this work under a foreman, and their output is from 280-300 hurdles per week. They work at a piece rate which is at present 1s. 2d. per hurdle, and at this price earn considerably higher wages than the other employees on the estate.

When certain improvements in the plant alluded to below are effected, the output should be materially increased, and the rate may be somewhat diminished in consequence. The remunerative value to the estate of the timber used in a standard 6 ft. by 4 ft. hurdle is reckoned at about 8d., and the finished hurdles sell readily at 48s. per dozen, delivered on rail. The transport charges to the nearest station are about 3d. per hurdle, while to the London area or the north and south of England generally it becomes about 8d. or 9d. During the last ten or eleven months between ten and twelve thousand hurdles have been sold to all parts of the Kingdom. Of course, to deal with this quantity, an active and efficient selling organisation is essential, and this and the general management are conducted from Colonel Addie's offices in Shrewsbury, and it is understood that the demand is now considerable, and proving to be in excess of the capacity of the plant.

Plant and Equipment.—The industry is carried on practically in the open air, as the workshop consists of little more than a roof over the machinery, and protection on one side from prevailing winds. The machinery and fixed plant consist of one 5-h.p. oil engine driving a circular saw about 18 in. diameter; one 9-h.p. oil engine which drives a circular saw about 28 in. diameter; a special appliance locally made for trimming the ends of the cross bars to a circular shape and to push fit into the mortice holes drilled in the posts. At one time this trimming was done by hand, but this simple apparatus can perform

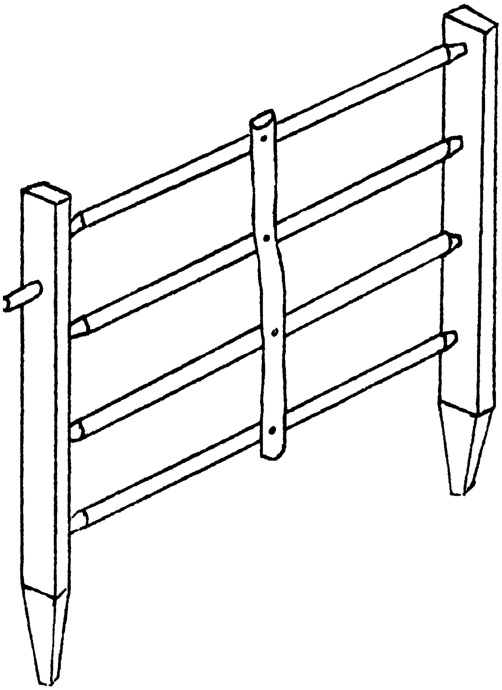

FIG. 1 -Stock Pattern 6 ft by 4 ft. Hurdle with 4 Cross Bars.

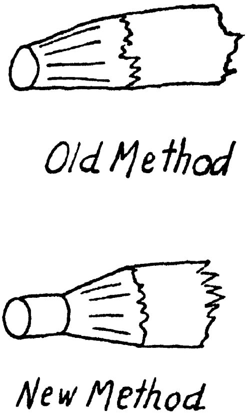

FIG. 2.—Cross Bar Tenons.

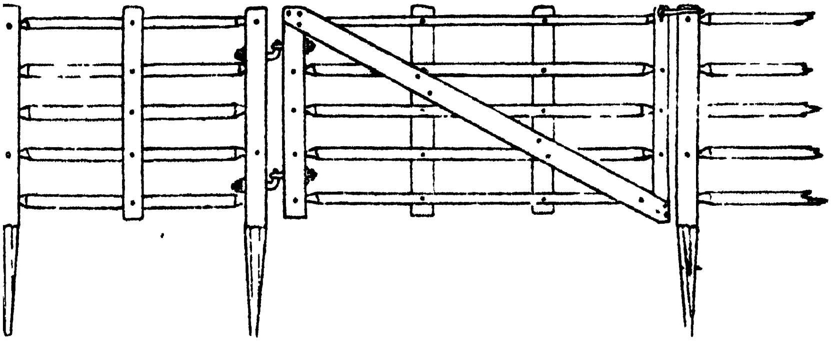

FIG. 3.—Standard 6ft. by 3 ft. Hurdle and Gate with 5 Cross Bars.

the operation much more perfectly at the rate of about 5 or 6 cross bars per minute as against the old rate of about 12-15 cross-bar tenons per hour.

The sketches show the difference between the old and new methods of trimming. The trimming machine consists of a hollow funnel-shaped tool-holder very similar to a spoke trimmer carrying an appropriately shaped internal knife. This is rotated at from 500-600 revolutions per minute, the rod to be trimmed is gripped near the far end in a hinged tong vice which allows of a small amount of movement backwards and forwards, and the end to be trimmed is forced into the rotating tool head until it comes up against its stop, when it is withdrawn finished. The cross bars having previously been cut by the saw to the correct overall length, they all become uniform as to length and size and shape of the tenoned ends, which ensures that the hurdles can be rapidly put together quite square, and with all the bars tight without any fitting or adjusting being necessary at all.

The posts are cut out with the large saw, and the mortice holes are drilled in them about 1⅛ in. diameter, using auger bits in two hand-operated Millers Falls wood-boring machines. Two men are continuously employed on the operation, which is probably the most arduous process in the whole of this hurdle industry, and it is intended in time to convert this also to a power-driven operation, which should have a considerable effect upon output.

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EGG AUCTIONS IN THE EASTERN COUNTIES.

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Ministry of Agriculture and Fisheries.

THE practice of selling eggs by auction has grown considerably during the past ten years, corresponding to a very rapid development of poultry keeping, especially in the Eastern Counties. It may be said that the egg auction is now a prominent feature of many of the weekly country markets.

Selling by auction is particularly useful to the smaller poultry keepers for the disposal of their produce, and also to buyers of new laid eggs for retail locally. The producer of eggs in quantities of 30 dozen and upwards weekly is often able to sell his eggs direct to the retailer, but the many people who now keep poultry in small numbers, and the smallholders and farmers, whose output is also limited, especially in the winter months, are not well placed for direct trading; and to these the auction offers a very favourable outlet. It is also favourable to the local shopkeepers, since, where the eggs are collected at their source by dealers or by agents for large organisations, there is frequently a shortage of new laid eggs available for local consumption during the autumn and early winter months, owing to the transfer of the local produce direct to London and other large consuming centres. The auction system therefore results in a more even distribution and should have the effect of stabilising the price.

The alternatives to the auction are frequently unsatisfactory, as they leave the producer in a poor position to make a bargain. For instance, if the eggs are collected at the door, the producer is not in a position to know the state of the market; and where the eggs are taken into the local market and sold to dealers, the price is generally fixed by the latter beforehand. Although the competition in egg dealing is keen, unfair advantage is sometimes taken of the producer under both these methods. On the other hand, when eggs are bought in this way unscrupulous producers will sometimes take advantage of the dealer by selling him stale eggs, with little risk of detection at the time of sale. In consequence, dealers usually fix their prices so as to cover losses incurred in this manner, with the result that the reliable producer receives less for his eggs than their value, while the unscrupulous and careless producer receives more than fair value. A premium is thus placed upon careless and unfair methods of marketing.

While it is possible that other methods of marketing practised in particular districts may be better adapted to the local conditions, the sale of eggs by auction has much to commend it in districts in which it has not yet received a trial. The breaking down of a long-established local custom and its substitution by something entirely fresh is not always easy of accomplishment, and this is especially so where the personal interests of individuals are affected. Egg auctions do not grow in a day and many of the best of these markets have taken several years to develop. They succeed best when within reasonable reach of the large local consuming centres from which the buyers can attend profitably without undue loss of time or expense in travelling. A sufficiently large quantity of produce is, of course, necessary to attract the buyers, and the bigger the market the more attractive it becomes to the best buyers. These egg auctions, in the Eastern Counties at any rate, probably realise the best prices, as compared with other methods of sale, during the seasons when eggs are scarce, but when once established they offer a good and steady market for the produce at all seasons.

There are many practical features which favour this method of marketing:—

(1) The interests of the auctioneer lie equally with the vendor and the purchaser, and to retain his business he must satisfy both parties, so far as this lies in his power. A poor price will drive away the vendor, and excessive prices wean the buyer from the market.

(2) Responsibility for payment is accepted by the auctioneer, which eliminates the producer's risk of bad debts. His charges are fixed on a commission basis, and the producer's cost of marketing is therefore regular.

(3) Since the responsibility for obtaining a fair market price rests with the auctioneer, he makes it his business to prevent "rings," and is generally very successful.

(4) The buyer has a fair opportunity to examine the produce before sale. By regular attendance he can also secure the class of eggs he requires and gain confidence in the eggs sent by individual producers.

(5) The eggs are usually offered with the name of the producer, and in some cases a guarantee is given signed by the producer that these are new laid. This practice brings most satisfactory results.

(6) Complaints after sale are investigated by the auctioneer, who knows the vendors as well as the buyers. If a complaint proves to be justified, a warning is given to the vendor, and repetitions of the offence will result in refusal to accept further produce from him for sale in the market.

(7) As a rule produce collected by dealers is not accepted in the auction market, for the reason that the vendor cannot be held entirely responsible.

(8) A vendor who markets his eggs carefully will benefit by receiving a price which is frequently 3d. per dozen higher than that paid for carelessly marketed consignments.

While grading to size and colour is not yet generally practised, and does not usually appear to recompense the producer for the trouble involved, it is nevertheless sometimes done to advantage, and will probably prove of more importance in the future with the growth of competition. There is a noticeable tendency to grade up the produce in most auction markets where the system is well organised. In view of the growth in home production and of the competition from foreign eggs this is an important feature.

The cost of transit to the auction market, as against the convenience and saving from collection at the door by a dealer, is sometimes a serious consideration to producers of small quantities of eggs who live at a distance from the auction. This has been overcome in some instances by the organised collection of the eggs by carriers from village centres.

There is always a large amount of work in the handling of eggs in small lots, and in consequence the sale of eggs is not always sufficiently attractive at first to the auctioneers of poultry, but when once the auctioneer has taken up this work the business has steadily increased.

The advantages of the system are that the charges for auction are moderate, the auctioneer does a satisfactory business, the producers receive prices which are in accordance with supply and demand, and a convenient market is established for disposing of eggs sent in by both large and small producers.

In practically every market live poultry are sold by auction, and in many cases special premises are provided at which the egg and poultry auction is held. The inclusion of fruit and vegetables in these auctions is also sometimes encouraged by the auctioneer, and proves an additional benefit to the allotment holder, whilst tame rabbits are sometimes sold in considerable numbers, and occasionally goats.

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MONTHLY NOTES ON FEEDING STUFFS.

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The Place of Silage in Stock-Feeding.—Farmers in increasing numbers are now turning their attention to the production of silage, with a view to making the farm self-supporting for stock-feeding, and at the same time to reduce the area under roots without decreasing the amount of food produced. The comparative claims of roots and silage as stock foods have been exhaustively and critically dealt with by Sir Daniel Hall in a recent paper read to the Farmers' Club, and readers are referred

DESCRIPTION.	Price per Qr.		Price per Cwt.	Price per Ton.		Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	s.	£	s.	£	s.	£	s.		s.	d.
Wheat, British - -	50/0	504	11/1	11	2	0	18	10	4	71·6	2/10	1·52
Barley, British Feeding	31/6	400	8/10	8	17	0	14	8	3	71	2/4	1·25
„ Danubian „	31/-	„	8/8	8	13	0	14	7	19	71	2/3	1·20
„ Persian „	28/6	„	8/-	8	0	0	14	7	6	71	2/1	1·12
Oats, English White -	33/-	336	11/-	11	0	0	16	10	4	59·5	3/5	1·83
„ „ Black & Grey	31/6	„	10/6	10	10	0	16	9	14	59·5	3/3	1·74
„ Scotch White -	37/6	„	12/6	12	10	0	16	11	14	59·5	3/11	2·10
„ Canadian No. 2 Western	31/-	320	10/10	10	17	0	16	10	1	59·5	3/5	1·83
„ No. 3 „	29/-	„	10/2	10	3	0	16	9	7	59·5	3/2	1·70
„ Feed -	28/-	„	9/1	9	2	0	16	8	6	59·5	2/9	1·47
„ American - -	27/-	„	9/5	9	8	0	16	8	12	59·5	2/11	1·56
„ Argentine - -	27/-	„	9/5	9	8	0	16	8	12	59·5	2/11	1·56
Maize, Argentine - -	42/-	480	9/10	9	17	0	15	9	2	81	2/3	1·20
„ American - -	40/9	„	9/6	9	10	0	15	8	15	81	2/2	1·16
Beans, English Winter -	50/-	532	10/6	10	10	1	17	8	13	67	2/7	1·38
„ Rangoon - -	—	—	8/9	8	15	1	17	6	18	67	2/1	1·12
Millers' offals—												
Bran, British - -	—	—	—	6	10	1	10	5	0	45	2/3	1·20
„ Broad - -	—	—	-	8	5	1	10	6	15	45	3/-	1·61
Fine middlings (Imported) - -	—	—	—	9	2	1	5	7	17	72	2/2	1·16
Coarse middlings (British) - -	—	—	—	8	0	1	5	6	15	64	2/1	1·12
Pollards (Imported)	—	—	—	6	17	1	10	5	7	60	1/9	0·94
Barley Meal - - -	—	—	—	9	12	0	14	8	18	71	2/5	1·34
Maize „ - - -	—	—	—	10	5	0	15	9	10	81	2/4	1·25
„ Germ Meal - -	—	—	—	9	5	1	2	8	3	85·3	1/11	1·03
„ Gluten-feed -	—	—	—	8	17	1	12	7	5	75·6	1/11	1·03
Locust Bean Meal -	—	—	..	8	0	0	11	7	9	71·4	2/1	1·12
Bean Meal - - -	—	—	-	12	5	1	17	10	8	67	3/1	1·65
Fish „ - - -	–	—		16	15	4	18	11	17	53	4/6	2·41
Linseed - - -		—	—	21	12	1	16	19	16	119	3/4	1·78
„ Cake, English (9°/₀ oil)	-	—	-	10	10	2	4		6	74	2/3	1·20
Cottonseed Cake, English (Egyptian Seed) (5½°/₀ oil)	—	- -	—	7	10	2	0	5	10	42	2/7	1·38
„ „ Egyptian (5½°/₀ oil)	--	—	—	7	7	2	0	5	7	12	2/7	1·38
Coconut Cake (6°/₀ oil)	-	—	—	8	0	1	15	6	5	73	1/9	0·94
Palm Kernel Cake (6 °/₀ oil)	—	—	—	6	5*	1	7	4	18	75	1/4	0 71
„ „ Meal (2°/₀ „)	—	—	—	5	5	1	8	3	17	71·3	1/1	0·58
Feeding Treacle - -	--	—	—	4	10	0	9	4	1	51	1/7	0·85
Brewers' grains, dried, ale	—	—	—	7	7	1	7	6	0	49	2/5	1·29
„ „ „ porter	—	—	—	7	0	1	7	5	13	49	2/4	1·25
„ „ wet, ale	—	—	—	1	4	0	11	0	13	15	0/10	0·45
„ „ wet, porter	—	—	—	0	19	0	11	0	8	15	0/6	0·27

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of April and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 78, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 5d.; P_2O_5, 4s. 3d.; K_2O, 2s. 10d.

to this paper* for details as to the comparative costs of producing roots and silage, as these notes deal only with the feeding of silage.

It has been suggested, and the suggestion is worthy of serious consideration, that the problem of feeding dairy cows by the soiling system can only be solved commercially by the adoption of silage in addition to feeding the green crops. The silo would then act as a convenient method of dealing with surplus green crops, and the silage made would prove a very convenient standby in the event of failure or partial failure of any green crop grown for soiling.

At first it was thought that silage would replace the hay crop, whereas now the tendency is to look upon it as a root substitute. Actually it is neither, and little harm can result if silage is regarded as a hay plus root substitute. In stock-feeding roots are chiefly used as a source of carbohydrates; their laxative properties and the absence of woody fibre make them an excellent food for mixing with hay and straw chop.

FARM VALUES.

CROPS.	Value per Ton on Farm.		Manurial Value per Ton.		Food Value per Ton.		Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£	s	£	s	£	s		s. d.	d.
Wheat	8	13	0	18	7	15	71·6	2/2	1·16
Oats	7	5	0	16	6	9	59·5	2/2	1·16
Barley	8	8	0	14	7	14	71·0	2/2	1·16
Potatoes	2	3	0	4	1	19	18·0	2/2	1·16
Swedes	0	18	0	3	0	15	7·0	2/2	1·16
Mangolds	0	16	0	3	0	13	6·0	2/2	1·16
Good Meadow Hay	4	11	0	16	3	15	31·0	2/5	1·29
Good Oat Straw	2	9	0	8	2	1	17·0	2/5	1·29
Good Clover Hay	5	1	1	4	3	17	32·0	2/5	1·29
Vetch and Oat Silage	2	1	0	8	1	13	14·0	2/4	1·23

Average samples of silage and hay contain approximately 10 per cent. and 26 per cent. respectively of woody fibre. It is the woody fibre present in a feeding stuff that chiefly determines the quantity of that feeding stuff that an animal will eat. Thus, if a 3-year-old bullock is allowed to have hay, silage or roots *ad. lib.*, it will be found that the maximum amount it will eat will be in the region of 25 to 30 lb. hay, 50 to 60 lb. silage, or no less than 1½ cwt. roots. This is shown in the rations given by stock-feeders using these feeding stuffs. The average amounts included in a ration varies from 8 to 15 lb. hay, 20 to 40 lb. silage, and 30 lb. to 1½ cwt. roots, according to the amounts available on the farm.

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* "Can Silage be substituted for Roots." Journ. of the Farmers' Club, Part II, 1923.

From the consideration of the chemical composition of silage, the following general statement can be made, which will be found to be supported by practice. Silage can be used with safety and advantage in feeding horses, sheep, cows and bullocks, but the fibrous character of silage precludes its use to any extent for pigs. Silage can be used to a limited extent for breeding sows and store pigs, but it is not advisable to give it to fattening pigs. The writer would be glad to hear from any farmer whose experience in feeding silage causes him to hold a contrary view.

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending May 9th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London.
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	14. 0	13.15	13. 10	13 1	16.10
,, ,, Lime (N. 13 per cent.)	...	12. 0	...	12. 7	19. 0
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
,, ,, ,, neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.)	...	..	...	2. 2	3. 5
,, (Pot. 14 per cent.)	2. 5	2 1	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	.	. .	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.)	...	...	..	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.)	9.10	7.10	8. 0	8. 0	3. 2
Sulphate of Potash (Pot. 48 per cent.)	...	12.15‡	11.15	11.10	4. 9
Basic Slag (T.P. 30-32 per cent.)	...	...	. .	3.15§	2. 5
,, ,, (T.P. 26 per cent.)	...	2.10§	...	...	...
,, ,, (T.P. 24 per cent.)	. .	2. 6§	2. 7§	...	...
,, ,, (T.P. 20-22 per cent.)	..	2. 3§	...	2.12§	2. 6
,, ,, (T.P. 16-18 per cent.)	...	..	2. 0§	2. 8§	2.10
Slag Phosphate (T.P. 60 per cent.)	...	...	.	6.15§	2. 3
,, ,, (T.P. 50 per cent.)	...	...	...	5.15§	2. 4
,, ,, (T.P. 40 per cent.)	..	...	...	...	...
Superphosphate (S.P. 35 per cent.)	4. 7	...	4. 5§	3.15	2. 2
,, (S.P. 30 per cent.)	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 5	8.12	...
Steamed Bone Flour (T.P. 60 per cent.)	8 10†	7.10†	7. 0	6.12	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)	12.15	...	12. 5	13. 7	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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A Successful Egg and Poultry Co-operative Society.

IN May of last year there appeared in the Ministry's *Journal* an article by Mr. Warren, Manager-Secretary of the Framlingham and Eastern Counties Co-operative Egg and Poultry Society, describing the origin and development of the Society, and the methods of working by which it had advanced to its present leading position in the egg industry. The Annual Report was presented at the Society's meeting on 20th February.

According to the report, the net profit for the year ending 31st December, 1922, was £5,441 5s. 1½d., as compared with £4,322 4s. 11½d. for the previous year. It is stated that the membership had increased from 5,091 (holding 53,031 shares) in 1921 to 5,373 (holding 56,291 shares) in 1922. The number of eggs purchased in 1922 is given as 22,327,712 and the value of sales (including poultry, etc.) £194,804—a decrease on the 1921 figure, caused, it is stated, to a great extent by lower values. The profit made during the year allowed payment of interest at the rate of 6 per cent. on the share capital, a 10 per cent. bonus to employees, and a bonus on the business done in eggs and other goods (poultry, rabbits, butter, etc.) by members at the rate of 6d. in the £, totalling £3,293. £472 was placed to reserve fund and a balance of £412 carried forward. The value of stock in hand at the end of the year was £1,634 14s. 8d. An increased trade in poultry and rabbits is said to be due to the accommodation afforded by the new premises, where space is sufficient for at least 300 fattening coops. During 1922, 6,234 fowls, 860 ducks, 91 geese, and 1,025 turkeys were disposed of, in addition to large quantities of rabbits, butter, honey and game.

The report states that the Committee were considering the building of further tanks for egg preserving, similar to those built and used at Ipswich during the previous year.

The Committee are open to receive applications for the establishment of agencies in East Anglia.

The Chairman of the Committee stated that the English egg producer would have to keep up the standard of eggs, and that unless this were done, the market for the best eggs would be lost and buyers would purchase foreign eggs.

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Grassland Demonstrations in Surrey.

SOME interesting demonstrations have been conducted in Surrey during the last two years by the Agricultural Education Sub-Committee of the Surrey Agricultural Committee. Although the rainfall in the spring and early summer of 1922 was greater than in 1921 it was not nearly heavy enough, and the ground was still very dry as the result of the exceptionally low rainfall in the preceding year; consequently both years were unfavourable for grassland trials. In spite of these adverse conditions the results from several centres have given information of a definite character and show that considerable improvement in the quality of the herbage in many fields can be brought about on heavy soils by the addition of phosphates only. This improvement is chiefly due in the first instance to the development of the wild white clover.

At Chiddingfold, on strong loam, a dressing of 30 per cent. basic slag (5¼ cwt. at a cost of £1 13s. 0d. per acre) in February, 1921, gave an increased yield of 8 cwt. of hay both in 1921 and 1922, or 40 per cent. in 1921 and 30 per cent. in 1922, while an equivalent phosphatic dressing of 20 per cent. basic slag gave an increase of 30 per cent. in 1921 and 20 per cent. in 1922. At Newdigate, on a heavy clay, the basic slags greatly stimulated the whole herbage, but there was very little difference between the effect of the 20 per cent. and the 30 per cent. grades.

Generally speaking, on lighter soils small but frequent applications of potash in addition to phosphates are essential. For instance at Brookwood, on a poor thin sandy soil, slag alone gave no increase in the yield of hay. In the first year (1921) of its application the addition of 41 lb. of sulphate of potash to 550 lb. of 20 per cent. basic slag per acre gave an increase of nearly 3 cwt., or 38 per cent. over the unmanured plot, but the effect was not lasting, as in 1922 this plot gave no increase in yield.

At Wootton Park, on a sandy soil on the Lower Greensand formation, a complete manure—2½ cwt. superphosphate, ½ cwt. muriate of potash, and ¾ cwt. sulphate of ammonia per acre—doubled the yield of hay (from 15 cwt. to 30 cwt.), improved the quality of the herbage, and also gave much better results than superphosphate alone, superphosphate and potash, or steamed bone flour, potash and sulphate of ammonia.

A report on these demonstrations, which are being carried out at 12 centres, has been issued by the Surrey Agricultural Committee and may be obtained from the Agricultural Organiser

(Mr. J. H. Mattinson, B.Sc.), County Hall Annexe, Kingston-on-Thames.

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Demonstrations at Rothamsted Experimental Station.

AN invitation is extended to Farmers' Clubs, Chambers of Agriculture and Horticulture and other bodies interested in agriculture or market gardening, to visit the Rothamsted Experimental fields during the summer. The Guide Demonstrator is Mr. H. V. Garner, B.A., Cambridge, who for the past two summers has very successfully served in this capacity and has been able to make the visits of farmers both useful and interesting.

Among important items of interest are:—Experiments on the manuring of arable crops, especially wheat, barley, mangolds, potatoes; manuring of meadow hay; effect of modern slags and mineral phosphates on grazing land, hay land, and arable crops: crop diseases and pests; demonstrations of good types of tillage implements, tractors, etc. At any convenient time between May and October there is sufficient to occupy a full day, and there is provision for assuring that the time shall not be lost, even if the weather turns out too bad to allow of close investigation of the fields.

The Director of the Station, Sir John Russell, will be happy to arrange full details with organisations of farmers, farm workers and others wishing to accept this invitation. Small groups of farmers are specially welcomed; if possible, arrangements should be made beforehand, but it is recognised that farmers' movements must often depend upon the weather, and no farmer need stay away because he has been unable to write fixing a date.

* * * * * *

Agricultural and Veterinary Research Scholarships.

THE Ministry invites applications for research scholarships in agricultural and veterinary science. The number to be awarded will depend upon the qualifications of candidates and will not in any case exceed seven. The scholarships are tenable for three years from 1st October, 1923, and are of the value of £200 per annum.

Applications must be received not later than 15th July, 1923, and must be made on the prescribed form, which together with a copy of the conditions attaching to these scholarships, may be obtained from the Secretary, Ministry of Agriculture and Fisheries, Whitehall Place, London, S.W.1.

* * * * * *

Weed Destruction by Spraying.

FARMERS should make arrangements in good time for the spraying of weeds. The Ministry's Leaflet No. 68 deals with the destruction of Charlock, for which sulphate of copper is recommended. For certain other weeds, especially Corn Buttercup (*Ranunculus arvensis*), known also locally as Corn Crowfoot, Starveacre, or Watch-wheels, spraying with a solution of sulphate of ammonia has been found useful. Corn Buttercup, sprayed when just coming into flower with a solution of 1½ to 2 cwt. of sulphate of ammonia in 50 to 60 gallons of water, applied at the rate of about 50 gallons per acre, has been considerably checked. Other weeds, such as Ivy-leaved Speedwell, Sheep's Sorrel, Charlock and Wild White Mustard have been effectively checked by sulphate of ammonia sprays. Particulars as to this method of dealing with cornfield weeds were given in this *Journal* for March, 1922, and farmers can always obtain advice on the subject from their County Agricultural Organisers. Information as to the use of sprays for the eradication of what is variously known as Thanet Weed, Chalk Weed, Hoary Cress and Whitlow Pepperwort, appeared in the May issue of the *Journal* (p. 158).

* * * * * *

Fream Memorial Prize.

THE Fream Memorial Prize is provided annually out of a fund entrusted to the Ministry under the will of the late Dr. Fream, who directed that the annual interest should be used for the purchase of books to be presented to the candidate who takes the highest marks in the examination for the National Diploma in Agriculture. This year the highest marks were obtained by Mr. Douglas H. Findlay, a student of Glasgow University and the West of Scotland Agricultural College, and the prize, the value of which is about £7 10s., will be awarded to him in the form of books.

* * * * * *

Registration of Small Cow-keepers.

THE attention of the Ministry has been called to the fact that some uncertainty exists among cow-keepers, dairymen, and purveyors of milk as to whether, and how far, the terms of Article 6 (6) of the Dairies, Cowsheds, and Milkshops Order of 1885, are affected by the provisions of the Milk and Dairies (Amendment) Act, 1922, which relate to registration of persons coming under the above categories.

Article 6 (6) of the Order lays down that:—

"A person who sells milk of his own cows in small quantities to his workmen or neighbours, for their accommodation, shall not, for the purposes of registration, be deemed, *by reason only of such selling,* to be a person carrying on the trade of cow-keeper, dairyman or purveyor of milk, and *need not, by reason thereof, be registered.*"

The Ministry is advised by the Ministry of Health that the Milk and Dairies (Amendment) Act, 1922, does not affect the exemption from necessity of registration which is allowed in the cases of persons who come under the terms of the above article.

* * * * * *

The Manufacture of Whey Butter.

THERE are two systems of making Whey Butter, (*a*) that employed on cheese-making farms; (*b*) that employed at factories.

Cheese-making Farms.—On cheese-making farms where there is not a sufficiently large quantity of whey to justify the use of a separator, the whey is run into a suitable vessel as soon as it is taken from the cheese, and is allowed to stand for the cream to rise. Whey "leads" are generally used, or sinks made of slate; tin is not to be recommended as the action of the acid in the whey causes it to wear out rapidly; old worn vessels such as copper tubs, etc., result in fermentations which taint the resulting butter. If possible, two vessels or tanks should be provided for raising the cream, so that one can be thoroughly cleansed and sweetened while the other is in use.

The whey should be set somewhere away from the dairy to avoid risk of taints, and the tank should be connected if possible with some means by which the whey can be run off to the piggeries when the cream has been skimmed. The whey should remain undisturbed until next morning, when a thin layer of cream will have risen to the top and may be skimmed off. This cream should be put in a vessel containing a plug hole at the bottom, preferably a glazed earthenware vessel. Four to five times its bulk of boiling water should be added and the whole allowed to remain undisturbed until next morning. The plug may then be removed and the water run off until the cream comes. This water will have clarified the fat and removed the curd and cheesy flavour. The cream should now be poured into a pan or pail that is kept to collect the bulk for churning and a small quantity of "starter," if obtainable, be added. The whey should be treated in this manner each day and the bulk of cream obtained should be stirred daily and churned at least once a week. If the cream sours too rapidly, a small quantity of salt should be added. The cream may be churned in the ordinary way but plenty of water should be mixed with it, and the butter also must be well washed with an abundant supply of water when in granules.

Factories.—Where a large quantity of whey is available it should be passed through a separator directly it comes from the vat. Some makes of separators have an adjustment to be used for whey, to prevent clogging by the small particles of curd it may contain. The immediate separation of the cream prevents the development of any distinctive cheesy flavour which the cream may acquire when made by the method given above. In addition, all the fat in the whey is recovered. Directly it is obtained the cream should be pasteurised as for ordinary butter-making, and then, if possible, about four times its bulk of good sweet separated milk should be added, and the whole ripened with a good "starter." This cream when treated in the ordinary way will produce a butter of extremely good quality, both as regards flavour and appearance. If pale in colour, butter colouring may be added just before churning. There is no perceptible flavour and it will market for the same value as butter made from ordinary cream.

Under normal conditions whey contains between 0.25 and 0.3 per cent. of fat, but in factories where mixed milks are used, this percentage may rise higher. Thus from every 1,000 gallons of whey from 20 to 30 lb. of butter can be made, according to the fat content of the whey. The yield is therefore worth the additional labour involved in obtaining it.

* * * * * *

Foot-and-Mouth Disease.—No outbreak of Foot-and-Mouth disease having occurred since the original outbreak confirmed on 3rd April at Billockby, near Acle, all general restrictions imposed in connection therewith were removed on 7th May.

On 23rd April, a fresh centre of the disease was discovered in seven out of ten dairy cows on premises at Plaistow, West Ham. There had been no movements on or off the premises for three months, but a possible origin is suggested by the fact that the owner had used straw which had been utilised for packing glassware imported from Austria, as bedding for the cows. Fortunately there have been no further developments, and all general restrictions imposed in connection with the outbreak were removed as from 22nd May. No outbreak has occurred in any other part of Great Britain since 23rd April.

Leaflets issued by the Ministry.—Since the date of the list given on page 1155 of the March issue of the *Journal*, the following leaflets have been revised.

No. 26.—Farmers and the Income Tax.
" 128.—Advice to Beginners in Bee-Keeping.
" 160.—The Cultivation of Lucerne.
" 321.—Notes on Essential Points in Poultry Feeding.
" 329.—Redemption of Tithe Rent Charge and Corn Rents.

The following Leaflet has been temporarily withdrawn.

No. 333.—Fish Meal as a Food for Live Stock.

* * * * * *

REPLIES TO CORRESPONDENTS.

Argentine Linseed for Sowing.—H.S. asks whether Argentine Linseed is safe to purchase and sow for a linseed crop, provided the seed has not been been heated during transit.

Reply: Leaflet No. 278 was sent and attention drawn to the fact that Argentine linseed is there recommended. Argentine linseed, however, which had been imported for crushing purposes, could scarcely be recommended for sowing unless it had first been carefully cleaned of weed seeds.

Seaweed as Fodder.—J.R. asks for information as to feeding seaweed to stock.

Reply: Referred to Professor Hendrick's article in this *Journal*, February, 1916, and to Bruttini "Déchets et Résidus" (International Institute of Agriculture, Rome, 1922). In both of these, information as to edible sorts is given, while Bruttini also refers to several processes of treating seaweeds with a view to the preparation of a feeding stuff. All of these processes involve washing in fresh water and drying, either artificially or in the sun. Specimens of seaweeds can always be named and inquiries as to their utility answered, if addressed to the Director, Royal Botanic Gardens, Kew.

Pond Mud as Manure.—K.Q. asks about application of pond mud to the land.

Reply: While this material does not usually possess much fertilising value, it will, if it be allowed to dry for a year and then be mixed with lime in the proportion of 1 part of lime to 10 or 20 parts of mud, form a useful compost for application to the lighter classes of arable land. Otherwise, after lying to dry throughout the summer it may be spread without further treatment on grass land. The nature of the mud, however, and the character of the soil to which it is proposed to apply it, are factors which need to be taken into consideration. The County Agricultural Organiser will be able to advise, with a knowledge of local conditions.

Wireworms.—M.T. asks for information as to chemicals and cultural methods for dealing with wireworms in a badly infested oat field.

Reply: The chemicals used so far in attempting to destroy wireworms have given, relatively, such poor effects on small plots that it is hardly worth employing them upon a larger scale. It would seem that many chemicals which under laboratory conditions give entirely successful results, are quite useless when taken into the field as they break down in the soil before they have had time to kill the wireworms.

The fact that wireworms have already destroyed a crop of winter oats is not. under any circumstances, particularly hopeful for the spring crop. If, however, oats have to be sown again on this field, the suggestions are that you should sow rather more seed than is customary, give sufficient sulphate of ammonia or nitrate of soda to ensure rapid growth, and keep the soil as firm as possible by rolling. The use of more seed and nitrogenous manures is likely to cause the crop to be "laid" before harvest, but presumably the chance ot obtaining a crop would be worth any additional trouble in harvesting. Trials in the North of England showed a very great gain from increasing the amount of seed sown in the case of wireworm-infested fields.

In regard to linseed, there are a certain number of records of this crop being damaged by wireworms, but they are relatively few, and it is considered that it comes next to mustard in its powers of resistance to attack. As a crop it would be far preferable to oats for sowing on a field known to be heavily infested.

Calcium Carbide Residue.—M.S. inquires whether expended carbide of calcium will be of use for the destruction of wireworms, and whether it is suitable for the ground or for any useful purpose in an orchard.

Reply : No consistent results against wireworms have been obtained from the use of spent calcium carbide. In general this substance can only be regarded as of equivalent value to calcium carbonate as a dressing for the soil. It would therefore be of use in correcting soil acidity but it is not possible to state in advance if it will have any definite insecticidal results.

Nicotine Insecticide.—Dr. A. asks for the right mixture for a nicotine aphis insecticide.

Reply : The following should be found satisfactory—nicotine (98 per cent.), ¾ of a fluid ounce ; soft soap, 1 lb.; water, 10 gallons. If by any chance you are so fortunate as to have a supply of rain water, then the soap may with advantage be reduced to ½ lb. per 10 gallons. If the wash is required for garden use it is useful to make up a stock solution containing the same quantity of nicotine and soap but one-tenth of the volume of water. This saves a good deal of trouble when only small quantities of wash are required.

Soft soaps vary greatly and it pays to get a really good brand of potash soap containing about 39–40 per cent. of fatty acids.

* * * * * *

NOTICES OF BOOKS.

Mites Injurious to Domestic Animals.—(Stanley Hirst, Asst-Keeper Dept. of Zoology, British Museum, Natural History. London : British Museum. 1922, 170 pp., 3/-.) An illustrated catalogue of parasitic mites (*Acari*) found on domestic animals. The arrangement is in families, beginning with *Sarcoptes*, or itch mites (the cause of sheep-scab or mange) which occupy more than half the pages of the book. An appendix on the acarine disease of hive bees records Dr. Rennie's recent discovery of the mite causing "Isle of Wight" disease.

Animal Nutrition.—(E. T. Halnan, M.A. London : Benn Bros., Ltd., 1923, 52 pp., 2/- net.) The first portion of this brochure deals with the organic chemistry of animal and plant life and their inter-relation as food, and a lucid description of the stomach and digestive organs of the pig, sheep, cow and horse, and of their respective capacities. An account of experiments to test the assimilation of components of various foodstuffs follows, and, with an explanation of the general economy of the body at various stages of development, leads to a scheme of scientific rationing to ensure efficient nutrition especially for milch-cows. The brochure is illustrated by charts and diagrams.

Poultry Keeping on the Farm.—(Edward Brown, F.L.S. London: Benn Bros., Ltd., 1923, 54 pp., 2/- net.) This gives an analysis of the poultry-carrying capacity of, and breeds suitable for, various types of soil, and discusses the merits and demerits of different methods of maintenance. It further contains suggestions for increasing the production of eggs and poultry, and for combining natural and artificial systems of hatching and rearing, based upon the author's experiments and observations.

Insect Pests and Fungus Diseases of Farm Crops.—(A. Roebuck, N.D.A., F.E.S. London: Benn Bros., Ltd., 1923, 55 pp., 2/- net.) This brochure deals with many pests and diseases of plants, and the soil and climatic conditions favourable to their development. The author discusses preventative and remedial methods of combating pests of cereal and root crops. The booklet contains 25 illustrations.

Farm Costing and Accounts.—(C. S. Orwin. London. Benn Bros., Ltd., 1923, 31 pp., 1/6.) A frequent cause of financial failure among farmers has been the lack of a check upon the details of expenditure in the various branches of their activities, the possession of which would enable them to recognise at a glance leakages and waste. A simple but effective system of book-keeping would obviate this, and Mr. Orwin's system is well worth studying and adopting by all practical farmers.

Poultry Craft.—(Will Hooley, F.Z.S., F.B.S.A. London: The Poultry Press, Ltd., 1923, 473 pp., 15/- net.) This book is intended to collect and impart the technical knowledge, both theoretical and practical, essential to successful handling of large and small flocks of birds, in view of the large increase in late years in the number of poultry keepers of all types. It comprises descriptions of breeds of poultry for household and commercial purposes, their housing, rearing and feeding, their anatomy and physiology, the diseases to which they are subject, and instructions for preparation of poultry for exhibition and the table.

State Control in War and Peace.—(Sir Arthur Goldfinch, K.B.E. London: W. H. Smith & Son, 1922, 48 pp., 6d. net.) This is a report of a lecture delivered before the Bradford Textile Society in October last. The lecturer, who acted as Director-General of Raw Materials for the War Office and Ministry of Munitions during the War, effectively exposes many of the uninformed and often self-contradictory criticisms directed against the working of Government control of industries, but proceeds to argue that the success of the measures initiated to meet the situation brought about by the national emergency offers no encouragement for the renewal of such ventures in peace time. Dealing with agricultural depression and low wages, Sir Arthur looks to the development of co-operative methods, in this country as in others, to make farming a self-supporting industry.

An Economic Survey of a Rural Parish.—(J. Pryse Howell. London: Oxford University Press, 1923. 31 p.p. 1s.) The interest in the study of rural social economics, to which the war gave a welcome stimulus, and which has found practical expression in the movement towards the revival of rural industries, and in the establishment of such organisations as the Village Clubs Association and other centres of social service and rural community work, continues to show evidence of its vitality. This is the more welcome at the present time, when the crisis through which the agricultural industry is passing calls for the completest understanding of all the problems involved. Mr. Howell, of the Institute for Research in Agricultural Economics, Oxford, from which so many valuable studies in agricultural economics have come, has followed a comparatively new line of investigation in this detailed survey of a single parish, which examines such facts as the systems of farming in vogue, the productivity of different sized holdings and the relative amounts of labour employed, the value of farm property, and the nature and cost of its equipment. As Professor Orwin points out in a prefatory note, the extension of such regional surveys to the country generally would not only throw much light on modern farming conditions, but would provide those who are working to promote rural welfare with the best possible insight into their subject, and would serve to establish the still more valuable element of personal contact.

ADDITIONS TO LIBRARY.

Agriculture, General and Miscellaneous.

Ashby, A. W., and *Byles, P. G.*—Rural Education. (227 pp.) Oxford: Clarendon Press, 1923, 2s. 6d. net [37(42).]

Thomson, R. B., and *Sifton, H. B*—A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States. (169 pp.) Toronto: University Press, 1922. [63.255.]

Wittmack, L.–Landwirtschaftliche Samenkunde. Zweite Auflage von Gras-und Kleesamen." (581 pp) Berlin. Paul Parey, 1922, 18s 8d. [63.1951; 63.33(*b*).]

Fruwirth, C.—Handbuch der landwirtschaftlichen Pflanzenzuchtung. Berlin · Paul Parey. [575.4.]

Band I.—Allgemeine Züchtungslehre Sechste Auflage. (443 pp) 1922, 12s. 4d.

Band II.—Die Züchtung von Mais, Futterrübe und anderen Ruben, Olpflanzen und Gräsern. Vierte Auflage. (274 pp.) 1922, 7s. 8d.

Band III.—Die Züchtung von Kartoffel, Erdbirne, Lein, Hanf, Tabak, Hopfen, Buchweizen, Hülsenfruchtern und kleeartigen Futterpflanzen. Vierte Auflage. (227 pp.) 1922, 6s. 10d.

Band IV.—Die Züchtung der vier Hauptgetreidearten und der Zückerrübe. Vierte Auflage. (483 pp.) 1923, 13s. 2d.

Mackenzie, J. R.—Brewing and Malting. (143 pp.) London: Pitman, 1921, 8s. 6d. net. [663.4.]

Live Stock.

Wallace, R., and *Watson, J. A. S.*—Farm Live Stock of Great Britain. Fifth Edition Revised and Enlarged. (xx + 868 pp.) Edinburgh and London: Oliver & Boyd, 1923, 30s. net. [63.6(42).]

Wisconsin Agricultural Experiment Station.—Bull. 350:—Minerals for Live Stock. (21 pp.) Madison, 1923. [612.394.]

Dairying.

National Farmers' Union.—Methods of Milk Production and Distribution in the United States and Canada. Report of an Inquiry made by Mr. E. W Langford. (24 pp.) London: National Farmers' Union, 1922, 3d. [63.7(71); 63.7(73).]

U.S. Department of Agriculture.—Bull. 1144:—Cost of Milk Production on 48 Wisconsin Farms. (22 pp.) Washington, 1923. [63.7(73); 63.714]

Natural History, Poultry and Bees.

Batten, H. M.—The Badger Afield and Underground. (159 pp.) London: Witherby, 1923, 8s. 6d. net. [59.9.]

"*Sonimor.*"—Egg-in-Kums (Incomes from Eggs): How to Make Them. (120 pp.) H. M. Morison, "Sonimor" Egg Farm, Leckhampstead, Newbury, Berks, 1923, 5s. [63.651.]

Taylor, E. H., Ltd.—Bees for Beginners. (129 pp.) Welwyn: E. H. Taylor, Ltd., 1923, 2s. 6d. [63.81.]

Sturges, A. M.—The Rational System of Bee-Keeping for the Prevention of Disease and Avoidance of Swarming. (60 pp.) The Author, "Shenstone," Hartford, Cheshire, 1923, 1s. net. [63.81.]

Engineering.

Foster, W. A., and *Carter, D. G.*—Farm Buildings. (377 pp.) New York: John Wiley; London: Chapman & Hall, 1922, 15s. net. [69(02).]

Putnam X. W.—The Petrol Engine on the Farm, including Construction, Repair and Management. (xxxi + 527 pp.) London: Page & Co., 1921, 16s. [63.17.]

U.S. Department of Agriculture.—

Farmers' Bull. 1295:—What Tractors and Horses Do on Corn-Belt Farms. (13 pp.)

Farmers' Bull. 1296:—Changes Effected by Tractors on Corn-Belt Farms. (11 pp.)

Farmers' Bull. 1297:—Cost of Using Tractors on Corn-Belt Farms. (14 pp.)

Farmers' Bull. 1298:—Cost of Using Horses on Corn-Belt Farms. (15 pp.)

Farmers' Bull. 1299:—Shall I Buy a Tractor? (9 pp.)

Farmers' Bull. 1300:—Choosing a Tractor. (12 pp.)

Washington, 1923. [63.175; 63.19.]

[This series of six bulletins has been prepared under the direction of a departmental committee of the U.S. Department of Agriculture in a study of all phases of the farm power problem. The relative adaptability and reliability of tractors and horses to work on corn-belt farms under both favourable and unfavourable conditions are discussed with a view to determining the form of power most satisfactory for specific farm operations. The results obtained by the employment of the different types of tractors on farms of various sizes; the work which can be done by the tractor; the saving of labour which can be effected by the use of a tractor; the costs of operating and repairing tractors, keeping and feeding horses, and the cost of power furnished by each, are carefully set out. These enable the man who is contemplating the purchase of a machine to determine approximately what influence the tractor may have on his farm, and the man who already owns one to compare his results with those obtained by others.]

Economics.

"*The Times*" *Agricultural Correspondent.*—The Future of Agriculture: Tour of Rural England. A series of articles reprinted from "The Times," October—December, 1922. London: "The Times" Office, 1923, 6d. [338.1.]

Manchester Guardian Commercial.—European Reconstruction. Section 14:—Food Supplies. (pp. 811-840.) Manchester, 1923. [338.1; 338.9.]

Knight, Frank & Rutley.—The Land Question II. (24 pp.) London: Knight, Frank & Rutley, 1923. [338.1; 333.5.]

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SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous.

Modern Seed Testing. The New Zealand Official Seed Station, *N. R. Foy.* (N Z. Jour. Agr., Feb., 1923, pp. 65-72.) [63.1951.]

The Value of Mineralogical Examination in Determining Soil Types, with a Method of Examination and a comparison of certain English and Scottish Soils, *J. Hendrick* and *G. Newlands.* (Jour. Agr. Sci., Jan., 1923, pp. 1-17.) [63.111; 63.113.]

The Determination of the Number of Bacteria in the Soil, *C. L. Whittles.* (Jour. Agr. Sci., Jan., 1923, pp. 18-48.) [63.115.]

Life History of Azotobacter, *F. Löhnis* and *N. R. Smith.* (Jour. Agr. Res., 10th Feb., 1923, pp. 401-432 and 9 plates.) [576.8.]

The Development of Agricultural Education in England and Wales, *Sir A. D. Hall.* (Jour. Roy. Agr. Soc. England, vol. 83 (1922), pp. 15-34.) [37(42).]

Agricultural Education and Research in Scotland, Part II.—The West of Scotland Agricultural College, *A. M'Callum.* (Scottish Jour. Agr., Apr., 1923, pp. 149-162.) [37(41).]

Field Crops.

Experiments in the Manuring of Beans and Red Clover, *A. W. Oldershaw.* (Jour. Roy. Agr. Soc. England, vol. 88 (1922), pp. 97-100.) [63.32; 63.33-16.]

Wheat Breeding Experiments, *R. H. Biffen.* (Jour. Roy. Agr. Soc. England, vol. 83 (1922), pp. 35-44.) [63.311.]

Live Stock.

Censuses of Pedigree Stock in Scotland in 1920 and 1921. (Scottish Jour. Agr., Apr., 1923, pp. 208-219.) [63.4(41).]

Importance of the Pig Industry, *J. E. Smith.* (Jour. Kent Farmers' Union, Apr., 1923, pp. 142-148.) [63.64.]

Inheritance in Swine, *E. N. Wentworth* and *J. L. Lush.* (Jour. Agr. Res., 17th Feb., 1923, pp. 557-582.) [575.1; 63.64.]

Wensleydale Sheep, *H. G. Robinson.* (Jour. Roy. Agr. Soc. England, vol. 83 (1922), pp. 97-109.) [63.631.]

Dairying.

Milk Recording and Feeding for Milk and Butter, *James Mackintosh.* (Jour. Roy Agr. Soc. England, vol. 83 (1922), pp. 44-60.) [63.711(*b*).]

Some Factors Affecting Milk Yield, *J. Hammond* and *H. G. Sanders.* (Jour. Agr. Sci., Jan., 1923, pp. 74-119.) [612.664; 63.711(*b*).]

The Utilisation of Whey, *C. Dampier Whetham, C. P. Stewart* and *L. Harding.* (Jour. Roy. Agr. Soc. England, vol. 83 (1922), pp. 73-96.) [63.715.]

Dairy Farming in Denmark, *A. H. Murray.* (Milk Industry, May, 1923, pp. 101-103.) [63.7(489).]

Dairy Farming in Victoria, *J. S. McFadzean.* (Victoria Jour. Dept. Agr., Feb., 1923, pp. 65-81.) [63.7(945).]

Poultry and Bees.

Poultry Keeping on the Farm, *A. G. Ruston.* (Scottish Jour. Agr., Apr., 1923, pp. 166-176.) [63.651.]

Isle of Wight Disease in Hive Bees, *J. Anderson.* (Scottish Jour. Agr., Apr., 1923, pp. 183-191.) [63.81 : 09.]

Economics.

Economic Conditions of Agriculture at Home and Abroad, *A. G. Ruston.* (Jour Farmers' Club, 1923, part 3.) [338.1.]

Commodity Prices and Farming Policy, *C. S. Orwin.* (Jour. Roy. Agr. Soc. England, vol. 83 (1922), pp. 3-14.) [338.1.]

Frank Finance of Forty Years' Farming, "*Home Counties.*" (World's Work, Apr., 1923, pp. 464-475.) [338.1.]

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W. 1.

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Sow July to September

SUBTERRANEAN CLOVER

For Winter and Spring Grazing.

Subterranean Clover provides high-class grazing and fattens rapidly. It is remarkable for its rapidity and luxuriance of growth; and is besides a first-class soil improver. It requires no more cultivation than Trifolium and may be sown broadcast well harrowing in, but does best drilled. There is no question of its hardiness, and will make appreciable growth during winter.

Whilst giving the best yield on good soil it is particularly adapted for light or gravelly land. Sown alone broadcast, use 10 lb. (60/-); if drilled, 8 lb. (48/-) per acre. The following mixtures are recommended:—

(a) 6 lb. Subterranean Clover, 10 lb. Perennial Ryegrass. Price 41/6.
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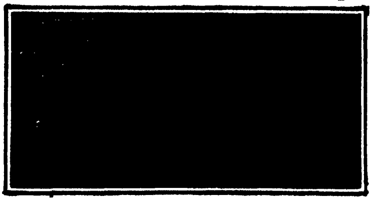

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXX. No. 4.

JULY, 1923.

NOTES FOR THE MONTH.

Report on Fruit and Vegetables.

THE Departmental Committee on Distribution and Prices of Agricultural Produce appointed by the Minister of Agriculture and Fisheries has now issued a second interim report* which deals with fruit and vegetables. A note on the first report, which concerned milk and milk products, appeared in the May issue of this *Journal*, p. 100. The Committee consists of the Marquess of Linlithgow (Chairman); Sir Basil Mayhew, K.B.E.; Mr. A. W. Ashby; Mr. E. R. Debenham; Dr. C. M. Douglas, C.B.; Mr. P. A. Hurd, M.P.; Mr. R. R. Robbins, C.B.E.; Mr. R. J. Thompson, O.B.E.; and Mrs. Margaret Wintringham, M.P.

The Committee has been at considerable trouble to obtain authoritative information from numerous producers', distributors' and consumers' organisations, and from other sources which were available. As a result the report is a mine of pertinent information on the organisation of the fruit and vegetable trade. It is illustrated by various interesting diagrams.

Growers should purchase the Report and study it for themselves, but it may be of interest to quote the concluding passages of the Report:—

"Finally, the picture presented to us by the evidence we have received is that of an industry deeply disturbed by war and post-war conditions. The less progressive growers and distributors appear to be waiting for a return to pre-war conditions. The more progressive growers and distributors, on the other hand, are fully alive to the needs of the moment. Perceiving the widespread change in prices and conditions of production and trade which are the aftermath of war, they are earnest in their endeavour to improve the methods and to lessen the costs of the various processes, whether of production or distribution, in which they are engaged. The best hope for the future lies with the industry itself. Producers must realise that marketing is the other half of production. They must make it their business to increase their knowledge of market conditions and requirements in order to dispose of their produce in the home markets to the best advantage in competition with produce grown in other lands. Distributors, for their part, must make every effort to eliminate archaic methods and to enhance the efficiency of the general distributive system. Retail distributors, in particular, should make serious efforts in the direction of increasing turnover when supplies are abundant, by charging lower prices to the consuming public. It should be the aim of all concerned in the industry to facilitate the passage of fruit and vegetables from the land to the home. The policy of preferring high prices and smaller turnovers to increased business on a lower price basis checks the even flow of supplies, and is inimical to the interests of the retailer himself, as, indeed, to the interests of all. In the course of this report we have set out numerous suggestions for improving the existing distributive machinery. Their cumulative effect upon the existing disparity ought to be substantial, and no opportunity of improvement, however slight, should be neglected."

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* Second Interim Report of the Departmental Committee on Distribution and Prices of Agricultural Produce—Fruit and Vegetables. The Report can be obtained through any bookseller, or from H.M. Stationery Office, Imperial House, Kingsway, W.C.2 (price 3s.).

* * * * * *

International Congress of Agriculture in Paris.

THE eleventh International Congress of Agriculture was held in Paris on the 22nd-26th May, and was attended by representatives from over twenty countries. The French Minister of Agriculture, M. Chéron, acted as Honorary President, and M. Méline, a former Minister of Agriculture, was President of this as of preceding Congresses. The Congress was indeed rendered possible by the financial assistance and help afforded by the French Government.

The work of the Congress was divided into seven sections, and in practice took the form of discussions on subjects in regard to which papers had been contributed, winding up in most cases with resolutions expressing in a more or less definite form the view of the meeting. It afforded an opportunity for an exchange of views and a statement of the experience of different countries on matters of common interest. In all, no fewer than 87 separate contributions were included in the proceedings of the Congress.

The scope of the Congress was in consequence very wide and covered a great variety of subjects, but it may be of interest to give some indication of the questions dealt with in the different Sections.

The first Section (Agronomy) was mainly devoted to questions relating to the improvement of wheat, potatoes and beet. A proposal was made to establish an International Association for the breeding of improved varieties of wheat, the idea being to establish a central office which would record the characteristics of all known varieties, promote the exchange of information between wheat breeders in all parts of the world, and publish a bulletin summarising results obtained in the improvement of wheat. Among other subjects this Section made a Recommendation that the international law as to patents should be extended so as to afford legal protection to the names under which new varieties of wheat are sold.

The third Section (Rural Economy) was of a less technical and more general character, the subjects discussed including the improvement of the lot of the agricultural worker, the development of agricultural associations, the taxation of land and the question of agricultural book-keeping.

On this last subject a paper was contributed by Sir Daniel Hall, and in the discussion which followed M. Laur, President of the Union des Paysans of Switzerland, drew attention to the remarkable progress which had been made in Switzerland by the adoption of a system whereby a book-keeper was employed co-operatively by an Association of farmers on a system similar to that adopted by milk recording Societies. By this means accurate accounts were kept on a very large number of farms. This was not merely of benefit to the individual farmers concerned, but the statistics of profit and loss thus obtained were of great value in meeting the criticisms of urban consumers regarding the prices of commodities like milk or meat, and in affording a reliable indication of the position of the industry.

The Live Stock Section dealt with milk recording as a means of developing milk production by the selection of cows with a high milk and butter yield, and increasing their commercial value. An allied subject which attracted a good deal of interest was the possibility of securing uniformity in the methods of judging stock and the system of entry in herd books, and also uniformity of certificates of origin and sanitary certificates of animals intended for export.

Other Sections of the Congress concerned themselves with vine growing, forestry, rural education and Colonial agriculture. The meeting concluded with an excursion to some of the experiment stations near Paris, followed by longer excursions into Normandy, the Nivernais, and the wine producing area in the east of France.

* * * * * *

Prices and Supplies of Agricultural Produce in 1922.

THE Ministry's annual report on the prices and supplies of agricultural produce and requirements in 1922 has now been published. After reviewing the changes in prices and wages in 1922 as compared with previous years the position during the past 18 months is summed up by saying that while agricultural prices declined sharply in 1921. growers were able by reduced wages and reduced prices of feeding stuffs and fertilisers to produce more cheaply in 1922 than in the preceding year. This advantage, which might have enabled them to balance receipts against expenditure, was lost by the further fall in cereals and potatoes. The year was also unfavourable generally for growers of market garden crops, as the prices of these declined to about pre-war level when the heavy crops of 1922 came to be marketed. Some commodities, particularly sheep, realised fair prices.

The report contains a few short tables of the total supplies of the chief agricultural commodities in Great Britain, distinguishing the quantities produced at home from those imported. These tables bring out clearly the contribution which the agriculture of Great Britain makes to the total requirements, and show that the proportions of the total supplies which are produced at home vary considerably with the different kinds of agricultural produce.

With reference to these tables, it is observed that " These figures may be used to point to the extent of the dependence of Great Britain on imports, whether from Ireland or other parts of the Empire or from foreign countries. From another point of view it may be considered that having regard to the dense population of this country and its relatively small area the home contribution is fully as great as can be expected from the area of land available. But it must be admitted that the figures emphasize the magnitude of the market which lies at the door of the British agriculturist, and suggest that an expansion of home production in at least some of these directions ought not to be a matter of impossibility."

The report, which forms Part III of the Agricultural Statistics, 1922, is published by H.M. Stationery Office, and may be purchased through any bookseller, price 1s.

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The Agricultural Index Number.

ALTHOUGH there have been some appreciable changes in the prices of individual commodities, the general index number of the prices of agricultural produce remained unchanged in May at 54 per cent. above the level of 1911-13. On the whole therefore agricultural produce was some 10 per cent. lower in value than a year ago.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	—
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

All classes of British grain realised higher prices than in April, wheat advancing by 11d. per cwt., barley by 5d. per cwt., and oats 8d. per cwt. Except in the case of barley there is usually a rise in May, but the increase this year has been relatively greater than before the War so that the index numbers increased by 3 to 6 points. Wheat at 37 per cent. above 1911-13 is higher than in any month since August last, but oats are still relatively dearer than wheat. Potatoes remained unchanged at 28 per cent. cheaper than in 1911-13, the slight fall in price in May being relatively the same as the decline in the base years. Hay usually becomes cheaper in the spring, but the decline this year was only 1s. per ton on the average, so that the index number shows a rise of one point. Hay is one of the few agricultural commodities which are dearer than a year ago, being now 41 per cent. above 1911-13 against 33 per cent. above in May, 1922.

Prices of fat cattle increased during May and were on the average about 8d. per stone higher than in April, this rise being relatively greater than in the base years, and fat cattle realised prices 53 per cent. above those ruling in May, 1911-13, against an increase of 51 per cent. in April. As is usual, fat sheep and fat pigs declined in price, but the index number increased slightly in each case as the fall was relatively less than before the War. During May fat sheep were at rather more than double pre-war prices, and fat pigs 72 per cent. above. Dairy cattle have been in poor demand except for the best animals, and realised about £1 per head less than in April, being only 50 per cent. dearer than in 1911-13. Store cattle and sheep became dearer, but in each case they are relatively cheaper than fat stock. Store pigs, on the other hand, though cheaper than in April, were still at a much higher level than fat pigs.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	May	Jan.	Feb.	Mar.	Apr.	May
Wheat ...	62	33	28	27	31	37
Barley ...	49	20	12	8	11	16
Oats	53	43	39	36	39	42
Fat cattle ...	70	61	61	54	51	53
Fat sheep ...	140	103	97	94	100	103
Fat pigs ..	91	102	88	77	71	72
Dairy cows ...	66	74	67	58	55	50
Store cattle ...	38	36	36	31	29	33
Store sheep ...	100	105	100	92	92	98
Store pigs ...	97	171	154	136	131	126
Eggs... ...	50	86	46	55	37	43
Poultry ...	110	81	80	81	75	77
Milk	27	90	90	87	70	63
Butter ...	54	73	72	70	68	40
Cheese ...	48	85	88	95	92	42
Potatoes ...	140	—1*	—5*	—12*	—28*	—28*
Hay	33	43	42	42	40	41

Owing to the decline in the prices of imported cheese, and the consequent lower prices paid for milk sent by producers in excess of their basic quantities, the average price of milk declined from 70 to 63 per cent. above the pre-war summer contract prices. The average price is, however, well above May, 1922, when the increase over 1911-13 was only 27 per cent. Butter showed a sharp fall in May, British butter at country markets averaging 1s. 4¾d. per lb. against 1s. 10¼d. in April, and was only 40 per cent. above the pre-war price. Cheese declined even more sharply and this season's cheese sold at only 42 per cent. more than in 1911-13, or 6 points lower than in May, 1922. Eggs recovered from the low level of April and were 48 per cent. dearer than before the War.

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* Decrease.

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Conciliation Committees in Agriculture.

THE Denbigh and Flint Conciliation Committee has reached an agreement to cover the period May to November, 1923, providing that wages in the area shall be (a) in the case of stockmen and horsemen 33s. for a week of 61 hours, to consist of 56 or 58 hours on weekdays and 5 or 3 hours respectively on Sunday, or 61 hours on weekdays, at the option of the employer; and (b) for other adult male workers 27s. 1d. for a week of 50 hours. A special clause stipulates that it is a fundamental condition of the agreement that the rates specified are minimum rates, and provision is also made for overtime, for rates for male workers under 21, for deductions from the cash wage in respect of allowances of board and lodging, and for a half-day being allowed on Saturdays wherever possible. The Merioneth and Montgomery Committee has also reached an agreement to continue to November, 1923, the terms being a rate of 31s. for 60 hours in the case of stockmen and wagoners, and a rate of 28s. for 52 hours in the case of other adult male workers. For Carnarvon an agreement has been made providing for a wage of 32s. 6d. (or 18s. in cash and board and lodging valued at 14s. 6d.) for a week of 60 hours. In the case of the Brecon and Radnor Committee an agreement has been reached on the recommendation of the Independent Chairman, providing for a rate for adult male workers of 30s. for a week of 53 hours.

* * * * * *

A Parasite of the Woolly Aphis.

IN view of the references in the technical Press to *Aphelinus mali*, a Chalcid parasite of the Woolly Aphis, it may interest *Journal* readers to know that a flourishing colony of this parasite exists at the Ministry's Pathological Laboratory at Harpenden. By the kindness of Dr. Marchal, of Paris, a small supply of parasitised Woolly Aphis was received early in the year. The Chalcid flies emerged from the dead aphides during April and were introduced into a cage containing a small Cox's Orange Pippin heavily infested with Woolly Aphis The Chalcids bred satisfactorily and at the date of writing a further generation of flies is appearing. It is hoped that before the close of the summer sufficient stock will be available to make a limited distribution of the parasite to one or two centres in fruit-growing districts, and that these centres will next year be able to provide sufficient material for a more general distribution. It is quite impossible at present to predict whether the parasite will prove of real importance in the control of Woolly Aphis, but there is already sufficient evidence to show that an extensive trial is worth while. Further information on the subject will appear in this *Journal* as soon as the experiments are in a more advanced stage.

* * * * * *

Weighing of Cattle: A Successful Experiment in Cornwall.

THE provision of weigh-bridges in sale yards is not yet general throughout the country, though at most sale yards in Scotland and the north of England fat cattle pass over the weigh-bridge before entering the sale ring, and the same system is adopted at many markets in other districts of England and Wales.

During the War all cattle were graded and sold by live weight, and although the system was much abused by farmers at first, they soon found out by weighing their cattle and selling by live weight, that they had in many instances given away to butchers and dealers a considerable quantity of beef and mutton under the old system of selling their stock at so much per head.

The grading scheme was much appreciated by the majority of Cornish farmers, and when it came to an end the farmers wished to continue to sell their cattle by live weight. The butchers and dealers, and to a certain extent the auctioneers, were not in favour but preferred to buy the cattle as they stood at a price per head, and consequently strong opposition was forthcoming. The Cornish Farmers' Union, however, were strongly in favour of the scheme of selling by live weight, and it was only after they decided to appoint their own auctioneers that the other parties consented to give it a trial.

The system adopted at Truro, Helston and other markets in Cornwall is as follows:—An ex-soldier is appointed and paid by the Farmers' Union at the rate of 2d. for each head of stock weighed, with a minimum pay of 10s. per day. He has to superintend the weigh-bridge and book the weight of each beast, and as the animal enters the sale ring he calls out the live weight and this is booked down by the auctioneer's clerk. The bidding is then conducted at so much per live cwt., and the necessary calculation for the total price of the animal is afterwards worked out by the auctioneer's staff. In case of any dispute the weight as booked by the ex-soldier is accepted as final. In cases where a fat cow or heifer is found, when slaughtered, to be in calf, a claim can be lodged by the purchaser with the auctioneer, and the vendor has to make some allowance. Generally this is met by the weight of the calf being deducted from the live weight of the animal, and in some cases a claim of up to £3 has to be met.

This system is in vogue in Cornwall at the present time and appears to give satisfaction to all parties. It has not been found to drive butchers and dealers to other markets for their supplies of fat stock. The system has, moreover, proved to be a great boon to a large number of young butchers, many of them ex-Service men of no great experience. The more experienced butchers now raise no objection, although they admit the other system suited them best, as they are now no longer able to get the " snips " which their experience enabled them to obtain on some occasions in former days. The auctioneers state that the disadvantage from their point of view is that the system involves more clerical work, but this is now much simplified by the use of ready reckoners.

The farmers are well satisfied with the scheme and feel they are now paid in full for their cattle, and it has a tendency to make them send their cattle to market in better condition. They see exactly what the butcher is prepared to pay per cwt. for well-finished cattle, compared with poorly fed beasts of inferior quality. The system could with advantage be adopted in other districts of the country.

A well-known Cornish farmer observed: "The selling by live weight is one of the best things the farmer has had for years, and selling cattle per head is dead for ever as far as Cornwall is concerned."

A great number of fat pigs are also sold by live weight in Cornwall, but not in the markets. The usual procedure is for the farmer to offer his pigs to buyers attending markets at a price per score lb. live weight delivered at the nearest railway station, and the pigs are then weighed at the station before being put on rail. This system is much in favour, as to send pigs to market entails men's time, horses and waggons, and also market tolls and other expenses, which are to a great extent avoided by delivering direct to a station, probably at a time when cake or manures have to be taken home.

Sheep are not sold by live weight but are often sold at so much per lb. dead weight, the seller to be present when the carcasses are weighed.

THE WEATHER AND THE FARMER.

The farmer is doubly interested in the weather. He needs to know, for as long beforehand as possible, what the weather is going to be; he is concerned, though to a less degree, with what the weather has been. Before almost every farming operation, haymaking, harvesting, ploughing, sowing, spraying, etc., he must exercise his weather wisdom; the progress of his crops will often cause him to consult his weather memory. It is the same with the market gardener and the fruit grower. For these, forecasts of the likelihood of rain at sowing or planting-out time and, particularly, warnings of probable night frosts and following sunshine should be of great benefit. Both in (1) forecasting future weather, and (2) in recording weather that is past, considerable assistance may be obtained from the Meteorological Office.*

I. **Weather Forecasts.**—A weather forecast is a brief description of the weather which is regarded as probable during the period to which the forecast relates. It is only expected to apply to the district specified when the forecast is issued.

For the purpose of compiling forecasts, observations are taken at the same hour four times daily at a large number of stations and telegraphed to the Meteorological Office. That Office then prepares weather maps embodying the main features of these observations and compiles forecasts accordingly.

A. *Forecasts by Telephone.*—Arrangements have been made for weather forecasts to be distributed each afternoon to telephone exchanges. For this purpose Great Britain has been divided into forty districts, and each exchange will have the forecast appropriate to the area in which it is situated.

The forecasts cover the period from six o'clock on the evening of the day of issue until six o'clock on the evening of the following day. The forecasts are available between five o'clock and midnight each day on demand by telephone and should be of special benefit to farmers and other residents in rural areas.

No charge, apart from any cost of telephoning, is made for these forecasts.

B. *Published Forecasts.*—A map based on observations taken at 6 p.m. is published in some of the London morning newspapers. It is accompanied by a "general inference," that is to say, a general description of probable weather movements, and by forecasts for different districts of the British Isles ("district forecasts") for the next 30 hours, *i.e.*, until the following midnight. Other newspapers (town and country) usually publish the "general inference" and the "district forecast" but not the map; information necessary for constructing a map is distributed by wireless telegraphy (see paragraph C. 3 immediately below).

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* Communications should be addressed to the Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2.

C. *Forecasts by Wireless Telegraphy.**—1. About 9 a.m., 3 p.m., and 8 p.m. G.M.T. each day "district forecasts" in code are broadcast by wireless telegraphy from London.

2. At 9.15 a.m. and 8 p.m. G.M.T. the "general inference" is sent out in plain language.

Those who possess wireless sets can thus obtain considerably later information than that published in the newspapers. Such up-to-date information is of especial value in the British Isles, where, as is well-known, the progress of the weather, for reasons which will be found explained in any book on the subject, is liable to rapid changes.

3. In addition to the above the Meteorological Office broadcasts in code four times daily the observations recorded one hour previously at 17 British stations. From these observations weather maps can be constructed.

D. *Forecasts by Wireless Telephony.*—A weather forecast for the following 24 hours for the area within a radius of about 50 miles of London is issued from the London station of the British Broadcasting Company at about 7 p.m. and 9.30 p.m. The forecast is followed by a statement of the barometer readings at certain stations. The readings given in the first message are those taken at 1 p.m., and in the second message those taken at 6 p.m. The pressure values given in the message refer to Mean Sea Level, *i.e.*, they are comparable with readings from a mercury barometer after the latter have been corrected, and reduced to sea level.

Forecasts for their respective areas are also issued from the Broadcasting Stations at Birmingham, Manchester, Cardiff, Newcastle and Glasgow. These issues are made at about 6.30 p.m. and 9 p.m.

E. *Forecasts by Telegram.*†—1. *Regular Forecasts.*—Regular forecasts for 24 hours or more in advance are despatched by telegram daily to subscribers. These forecasts are normally issued in the afternoon, to cover the weather of the following day, but forecasts for the same day can be issued in the early morning if desired. For these telegrams a fee of 6d. per week, plus telegraphic costs (calculated on an average of 1s. 3d. per message) is charged.

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* Full information as to these wireless messages, with a key to the code used, is to be found in "The Wireless Weather Manual" (M.O.255) (London, H.M. Stationery Office, price 9d.). Full particulars of the coded data messages issued in this and other European countries will be found in "Particulars of Meteorological Reports issued by Wireless Telegraphy," M.O. 252, Price 2s. 6d. Supplements issued from time to time give notice of changes.

† Further particulars which are given in M.O. Form 2450 should be obtained from the Meteorological Office.

2. *Spells of Settled Weather.*—Another type of forecast, which is sent by telegram, gives notifications of the setting in of spells of fair settled weather and of their break-up. These telegrams tions. The charge from May to September is 6d. for each forecast, in other months 2s. 6d., in addition to the cost of telegraphy.

Those desirous of obtaining forecasts of either type (1) or (2) above should communicate with the Director of the Meteorological Office, Air Ministry, Kingsway, London, W.C. 2, enclosing a postal order or a cheque to cover the cost of the messages required ; in the case of the type (2) a deposit of not less than 7s. 6d. should be sent, any unexpended balance being returned on the conclusion of the service. The shortest address which may be used for the telegrams should be stated.

3. *Special Forecasts.*—The Meteorological Office will send by telegraph forecasts of such conditions as spells of frost, ground frost, etc , at a fee of 2s. 6d. plus cost of telegram

The observations broadcast in code by wireless telegraphy by the Meteorological Office (see paragraph C.3 above) should be used extensively by amateurs, many of whom may care to take the opportunity of keeping themselves up-to-date with weather movements.

Failing this a study from day to day of the map published in the newspapers together with some knowledge of the methods used by scientific forecasters will give anyone who cares to take a little trouble a useful stock of weather wisdom. And it is hoped that many will take this little trouble, for it is only by such general effort that the science of one generation can become the common knowledge of the next. Considerable assistance is also afforded in this direction by the maps issued with the Daily Weather Report (see below).

It is of great importance, too, that volunteers should be found to undertake the task of comparing general weather with local weather. In various parts of the country there is a great deal of local weather-wisdom, which, owing to the more unsettled conditions of modern life, is in danger of being forgotten. It is to be remembered that the Meteorological Office can only give a general forecast applicable to the district as a whole and a knowledge of local peculiarities will often enable a local observer to modify the general forecasts accordingly.

Note.—The maps issued with the "Daily Weather Report" of the Meteorological Office will be found very useful for checking maps prepared by those interested from the observations sent out by the Meteorological Office. The "Daily Weather Report" is issued in three sections: (1) British Section, (2) International Section, (3) Upper Air Section. The British Section is issued at noon, with "general inference" and "district forecasts."

The cost, post free, of any one section is 6s. 6d. per quarter, or 13s. for all three sections. The International Section is probably the most useful for the study of weather, but the British Section must be referred to for the data for the British Isles which it gives. Further particulars may be obtained from the Meteorological Office.

The following books, which may be obtained through any book-seller, may be recommended:—

The *Weather Map*, by Sir Napier Shaw. (London, H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 1s. 3d., postage 1d.)

Meteorology, by R. G. K. Lempfert, M.A. (London, Methuen, 7s. 6d. net.)

A Short Course in Elementary Meteorology, by W. H. Pick, M.A. (London, H.M. Stationery Office, 1s. 6d., postage 2d.)

Forecasting Weather, by Sir Napier Shaw, F.R.S., Sc.D. (London, Constable. New Edition in preparation.)

The Weekly and Monthly Weather Reports (see below) will also be useful.

A Meteorological Glossary. (London, H.M. Stationery Office, 1s., postage 2½d.)

II. **Weather Records.**—A. *Records for Long Periods.*—Climate and soil are of chief importance in deciding what crops to grow. Climate summarises the weather of any particular locality and its variations.* When the weather has been observed for a sufficiently long time, we are able to obtain valuable particulars of the average temperature, rainfall, etc., at different times of the year at each place, besides (what is also very important) knowing whether the climate is equable or fickle.

There is still much to be done in determining what sort of climate best suits each crop. It is known, for instance, that, generally speaking, the climate of eastern England is better suited to wheat than is that of the west. But certain varieties might be found to stand the western climate better than others; and where a crop is found to be unsatisfactory in a district, it may be profitable to cultivate a variety more suited to the climate. Again, there are certain critical periods in the growth of most plants; and where unfavourable conditions often prevail just at a critical period, it might be advisable to select varieties of which the critical period falls earlier or later. Tables showing the average rainfall, temperature, etc., at different times of the year are published by the Meteorological Office. With a knowledge of the requirements of the crops and live stock, a farmer moving to a new district, or trying a new crop, such as sugar beet, in a familiar district, could by studying these records, form some opinion as to how far he is likely to be successful.

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* *See* the article on "Climate" in the Meteorological Glossary. (London, H.M Stationery Office, price 1s.)

NOTE.—The averages are published in the "Book of Normals." Section I of the "Book of Normals" gives monthly averages of Temperature, Rainfall and Sunshine for over 200 British stations. Section II gives weekly, monthly, quarterly and seasonal averages for the twelve weather districts of the British Isles. Section III contains coloured maps, based on Section I, showing average monthly temperature (highest day and lowest night) rainfall and sunshine. Section IV (in the press) will give for selected stations the temperatures in greater detail, and also the frequency of days of gale, frost, snow, snow-lying and hail. The latter tables should be of value in questions of agricultural insurance. Sections I, II and III are obtainable from H.M. Stationery Office, price 2s., 9d. and 1s. 6d. respectively.

B. *Current Records.*—As mentioned above, much more information is still wanted as to the climatic requirements of each crop, and also as to the effect of the weather at any given period. The weekly and monthly records of the weather will show what have been the outstanding features in successive weeks or months. It will not always do to say that a spell of unusual weather has necessarily been the cause of a large or small crop; the connection between the two is a subject of research, to be undertaken by Research Institutes, Agricultural Colleges and similar Institutions. Vague statements concerning the weather are apt to be misleading, and the appearance of the growing crop is not the sole guide to the ultimate yield. But by carefully watching weather records, and the changes in the growing crops, farmers should obtain much valuable knowledge of the effect of unusual rain or warmth, etc. By keeping such records themselves, and afterwards measuring the yields of their crops, farmers will in time not only learn which weather conditions are really favourable or the reverse on their own soil, but will assist in solving the general problem of each plant's likes and dislikes.*

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* For an outline of the more scientific aspect of the influence of weather on crops see this *Journal* for August, 1922, p. 432.

NOTE.—The Weekly Weather Report gives details of weather (warmth, rainfall and sunshine at over 20 stations) for the past week; notes on the wind, and also a summary of the weather for the week, and for the season and year in progress, as compared with the normal weather.

The Monthly Weather Report summarises weather records from some 300 stations and publishes five charts (wind, movements of depressions—*i.e.*, regions of low barometric pressure, temperature, sunshine and rainfall).

The Annual Summary does much the same for the year.

The Annual Subscription to the Weekly Weather Report, including Introduction and Guide to the Tables, is £2, post free.

The Annual Subscription to the Monthly Weather Report, including the Introduction and Annual Summary, is 10s., post free.

Specimen copies of the Daily, Weekly and Monthly reports may be obtained free from the Meteorological Office.

NOTE.—Orders should be made out as follows:—

Daily Weather Report.—To the Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2, remittances being made payable to the "Deputy Secretary, Air Ministry," and crossed "Bank of England A/c of Paymaster General."

Weekly Weather Report and Monthly Weather Report.—To the Director of Publications, H.M. Stationery Office, at any of the following addresses:—

Imperial House, Kingsway, London, W.C.2;
28, Abingdon Street, London, S W.1;
York Street, Manchester;
1, St. Andrew's Crescent, Cardiff;
120, George Street, Edinburgh;

remittances being made payable to "The Director of Publications" and crossed "Bank of England A/c of Paymaster General, H.M. Stationery Office."

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ALSIKE CLOVER.

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ALSIKE clover (*Trifolium hybridum*) derives its common name from the fact that it was first introduced into this country from the village of Alsike in Sweden. Unlike red clover and white clover it is not indigenous to Britain, but is native to temperate Europe and occurs also in Asia and Algeria; it is not common in Southern Europe. The specific name of *hybridum* was given to it by Linnaeus who erroneously regarded it as a hybrid between red clover and white clover.

Description of the Plant (see Plate I).—Alsike clover is a perennial plant, although in this country it does not usually persist in quantity for more than from three to five years. In manner of growth it comes nearer to late-flowering red clover than to broad red clover.

It can readily be distinguished from all forms of red clover by the fact that the plant is quite devoid of hairs. The leaves are slightly toothed and the flower head, which is usually pale pink is borne on a fairly long stalk. The stipule at the base of the leaf stalk is quite different from that of red clover; in the case of red clover the stipule is attached to the stem of the leaf for the greater part of its (the stipule's) length, and ends in a bristle-like point; the stipule of Alsike clover is not joined to the stem of the leaf in the same way and gradually tapers to a fairly long point.

Alsike clover is rather more surface-rooting than the red clovers, but if adult plants of the two species are compared it will usually be found that Alsike clover has produced the greater mass of roots.

Alsike clover is variable but not to the same extent as red clover, and there is certainly not so much diversity amongst the cultivated forms as with red clover.

Description of the Seed and Impurities (see Plate II).—The seeds of Alsike clover, like those of white clover, are heart-shaped, but plump, the seeds of the two species being about the same size. Alsike gives about 715,000 and white about 760,000 seeds to the pound The seeds of both species are smaller than those of red clover which gives 230,000 to 279,000 seeds to the pound. The seeds of Alsike clover are usually of various shades of green deepening almost to blue or black, the seeds frequently having a somewhat marbled appearance. Good samples should be bright with a nice colour range—older and poorly harvested samples usually assume a uniform brown or reddish brown colour.

Alsike clover is grown for seed in this country, but not to the same extent as red clover, most of the seed on the market being imported, chiefly from North America and from the Continent. Home-grown seed and that from America does not frequently contain dodder, but samples from Europe are often contaminated with the seeds of this parasite.

Samples of Alsike clover are liable to contain as much impurity as red clover and sometimes more. The chief weed impurities met with are Sheep's Sorrel (*Rumex Acetosella*), Self Heal (*Prunella vulgaris*), Campion (*Lychnis* and *Silene* spp.), Soft Cranesbill (*Geranium molle* and *pusillum*), Rib Grass

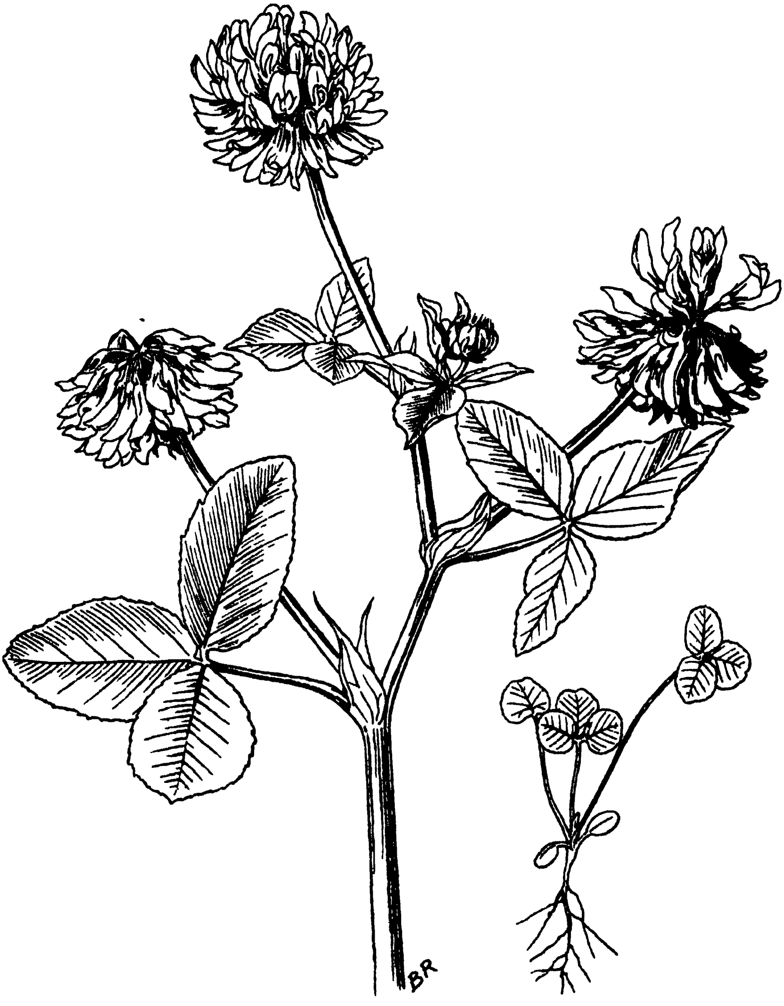

PLATE 1.—Alsike Clover (*Trifolium hybridum*) in Flower (natural size) and Seedling.

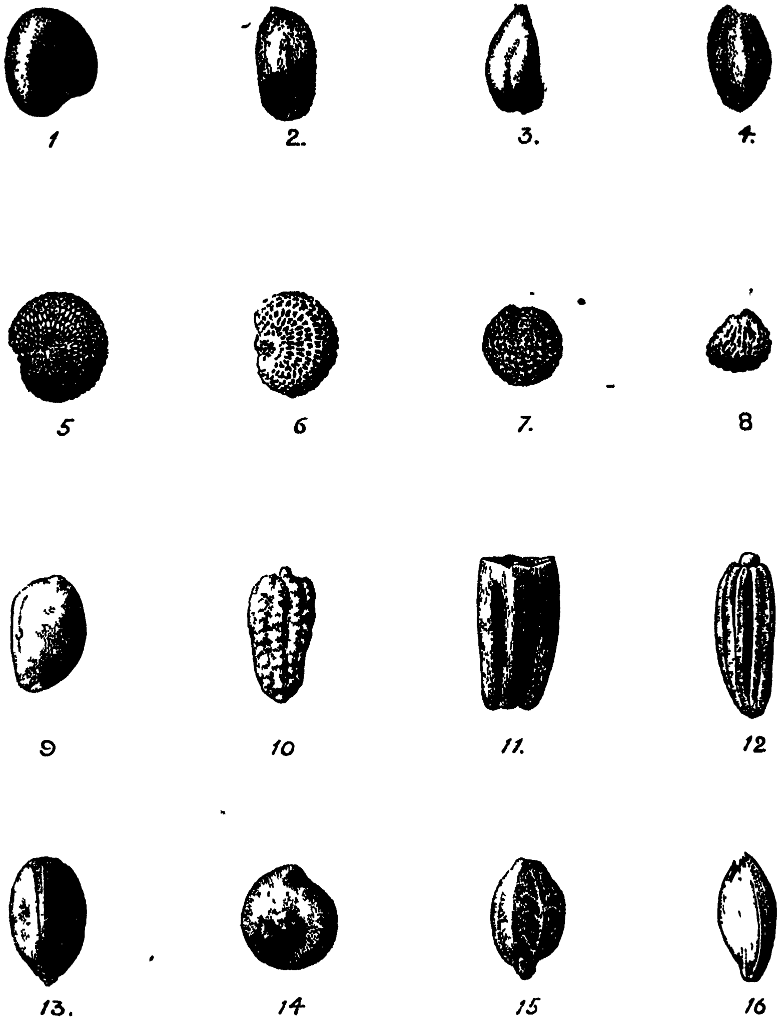

PLATE 2.—Seeds in Alsike Clover Samples, all × 10.

1. Alsike Clover *(Trifolium hybridum).*
2. Tumbling Mustard *(Sisymbrium altissimum).*
3 Treacle Mustard *(Erysimum cheiranthoides)*
4 Small seeded False Flax *(Camelina microcarpa).*
5 Night flowering Catchfly *(Silene noctiflora).*
6 White Campion *(Lychnis alba)*
7. Common Chickweed *(Stellaria media).*
8 Mouse ear Chickweed *(Cerastium vulgatum).*
9. Dove's Foot Cranesbill *(Geranium molle).*
10 Stinking Mayweed *(Anthemis Cotula)*
11. Scentless Mayweed *(Matricaria inodora)*
12 Ox-eye Daisy *(Chrysanthemum Leucanthemum).*
13. Self heal *(Prunella vulgaris)*
14. Fat Hen *(Chenopodium album).*
15. Sheep sorrel *(Rumex Acetosella).*
16. Timothy grass *(Phleum pratense).*

(*Plantago lanceolata*), and Mayweeds (*Anthemis* and *Matricaria* spp.).

Timothy, trefoil and white clover are frequent and sometimes abundant impurities of Alsike.

Agricultural Uses.—Alsike clover is not used to a very great extent in rotations; it is, however, considerably less susceptible to both eelworm disease and stem rot (*Sclerotinia trifoliorum*) than red clover; consequently in cases where clover leys are deemed to be essential even on " sick " land Alsike is to be preferred to red clover. When sown alone the usual seeding is about 8 to 12 lb. per acre. Pure Alsike or leys where Alsike predominates must be both grazed and fed green to stock with even greater care than red clover, particularly when it is in the flowering stage.

Alsike clover can be grown successfully under a wider range of soil and climatic conditions than can red clover; it withstands both acid conditions and excessive wet remarkably well and is considerably more winter-hardy than many strains of red clover. It can be grown to advantage under irrigation. Alsike clover is, therefore, a most valuable plant for use in seeds mixtures for leys on wet and waterlogged soil and, generally, for both rotations and longer leys at high elevations and in regions of high rainfall. In wet climates it has the further advantage that it may be cut for hay over a longer period than red clover. It should be included in seeds mixtures whenever there is any risk of a failure of " take " from the red clover, and thus on wet soils and in wet districts a few pounds of Alsike added to the red clover for even a one year ley would be in the nature of an insurance. Alsike and Timothy make a good combination for short duration leys on wet and heavy soils, while recently Alsike and cocksfoot have proved a successful combination on more normal soils. When Alsike is the only clover used for a short duration ley, from 5 to 7 lb. per acre should be employed. In more complicated mixtures for longer duration leys the amount usually varies from 1½ to 2½ lb per acre. It has been remarked that Alsike Clover has rather a similar growth habit to late-flowering red clover; these clovers are therefore to some extent mutually incompatible and are not both likely to do themselves justice when sown in large amounts in the same mixture. If and when late-flowering red clover is chiefly desired it is wisest only to include about 1 lb. of Alsike with 3 to 3½ lb. per acre of late-flowering red clover. This amount of Alsike will ensure some stand of clover if for any reason the late-flowering red fails, without seriously hampering the development of the latter if a good " take " results. The source of origin of the seed in relation to crop production does not appear to be of as great importance in the case of Alsike as of red clover, but this is a matter demanding further investigation.

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IMPROVEMENT OF POOR GRASS LAND IN EAST SUFFOLK.

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THERE is in East Suffolk poor grass land of the following quite distinct types, and, as far as possible, experimental plots have been laid down on all of them :—

(i) *Poor Heavy Land Grass.*—Probably a larger area of this exists than of any other type. Much of it is covered with thorns and the general tendency of this type of land is to grow whitethorn, unless it receives constant attention.

(ii) *Poor Mixed Soil Grass.*—There is not such a great area of this, as mixed soil is generally under tillage, for which purpose it is, under the climatic conditions of East Suffolk, much more suitable than for grass.

(iii) *Poor Light Land Grass.*—Much of this is hardly worthy of the name of grass land, as it produces practically nothing and may almost be described as derelict.

(iv) *The Marshes,* situated on the banks of the rivers, and near the sea. These vary much in type and are quite a distinctive feature of the grass land of the county.

Experimental plots on these various types of grass land may be considered in the above order.

1. **Poor Heavy Land.**—*Experiments at Saxmundham (Rendham) Experimental Station.*—The soil is a poor thin-skinned boulder clay. The field in which these experiments are conducted was nearly derelict twenty years ago, when taken over by the County Council. At the present time a field within twenty yards of the experimental field is still covered with bushes. Table I gives the manurial dressings applied and the yields of hay from the experimental plots.

Of special interest at the present time are Plots 3, 5, 6 and 7, which have received comparatively heavy dressings of superphosphate several times and which still maintain their yield. This shows that should it be proved that basic slag becomes shorter in quantity and inferior in quality in the future, heavy land farmers in East Suffolk may rely upon getting good results on their pastures from superphosphate, provided that their land contains sufficient lime.

TABLE. I—*Poor Heavy Meadow Land* (*Saxmundham*).

Each plot ¼ acre except Plots 1A, 1B, 2A and 2B, which are ⅛ acre.

	Treatment. (The dates given are those on which the manurial dressing was applied).	*Yields of Hay.*				Average 1902-1922 (grazed 1908).
		1919.	1920	1921.	1922.	
		cwt.	cwt.	cwt.	cwt.	cwt.
1A.	10 cwt basic slag, 1901, 1907, 1912, 1915-16, 1919-20 ...	14·2	21·5	16·5	25	24·6
1B.	10 cwt. basic slag, 1901, 1907, 1912, 1915-16, 1919-20, 2 cwt. kainit, 1909, 1912, 1915-16, 1919-20	15·5	26	18	27	26
2A.	5 cwt. basic slag, 1901, 1904, 1907, 1912, 1915-16, 1919-20 2 cwt. kainit, 1909, 1912, 1915-16, 1919-20	14	25	19	24·5	21·6
2B.	5 cwt. basic slag, 1901, 1904, 1907, 1912, 1915-16, 1919-20 2 cwt. kainit and 1 cwt. nitrate, 1909, 1912, 1915-16, 1919-20	14·6	26·5	16·5	24·5	22·8
3.	7 cwt. superphosphate, 1901, 1904, 1907, 1912, 1915-16, 1919-20	14	23	18	23·75	22·5
4.	Unmanured	8	10·75	10·5	11·5	9·8
5.	7 cwt. superphosphate, 3½ cwt. kainit { 1901 1904 1907 1912 1915-16 1919-20	14·6	29·5	18	25	24·3
6.	7 cwt. superphosphate, 10 cwt. lime { 1901 1904 1907 1912 1915-16 1919 20	14·5	28·5	13·5	22·75	23·5
7.	7 cwt. superphosphate, 71 lb. sulphate of ammonia { 1901 1904 1907 1912 1915-16 1919-20	15	29·5	14	27	25·4
8.	6 cwt. dissolved bone in { 1901 1904 1907 3½ cwt. bone meal in { 1914 1915-16 1919-20	13·4	24·25	13	22·5	21

NOTE.—1915-16, 1919-20 means the winter of 1915-1916, 1919-20.

Sheep Grazing Plots at Saxmundham (now arable).—Part of the area was manured with 10 cwt. of basic slag in 1904 and again in 1912, and the whole was grazed with sheep. The manured portion gave a profit, after paying for the manure, of 17s. 2d. per acre per annum over the period of years.

The land was ploughed up from grass and the following crops obtained per acre. The object of this experiment was to ascertain the improvement in the crops (if any) due to the residual effect of the basic slag upon the fertility of the soil:—

	1919.	1920.	1921.	1922.
	Mixed Beans and Peas.	*Wheat.*	*Barley.*	*Mangolds.*
Plot 1. No manure	29·7 bus. corn.	29½ bus. corn.	31½ bus.	23 t. 15 cwt.
on grass	42 cwt. straw.	35 cwt. straw.	—	—
Plot 2. 10 cwt. basic	40 bus. corn.	38·8 bus. corn.	43½ bus.	26 t. 10 cwt.
slag in 1904 and again in 1912	62 cwt. straw.	45 cwt. straw.	—	—

The continued superiority of the slagged over the unslagged plot is undoubtedly due to wild white clover, which grew most luxuriantly on the slagged plot for years before it was ploughed up.

Park Farm, Shadingfield (Mr. G. Mitchell).—The field chosen adjoins the railway from Brampton to Beccles. The land was covered with thorns, the bushes being 10 to 12 ft. high, until the spring of 1920, when they were removed, and manures applied in March, 1920.

The following are observations on the plots made as a result of several inspections:—

Plot.

1. No manure.—Very poor.
2. 800 lb. 28 per cent. basic slag (containing 100 lb. phosphoric acid).—This has been a very good plot. The basic slag caused a great growth of wild white clover, with the consequence that the cattle have grazed it very closely.
3. 800 lb. 28 per cent basic slag (containing 100 lb. phosphoric acid), 224 lb. kainit.—Very good; similar to Plot 2. It is doubtful whether the additional application of kainit paid.
4. 370 lb. ground Algerian phosphate (containing 100 lb. phosphoric acid).—This plot is slightly better than the "No manure" plot, but is very inferior to Nos. 2, 3 and 5.
5. 728 lb. 30 per cent. superphosphate (containing 100 lb. phosphoric acid).—Very good; equal to Nos. 2 and 3. The effects of the superphosphate on this plot were visible in the season 1920, *i.e.*, before the other manures had been given time to act.

When inspected on 7th May, 1923, Plots 2, 3 and 5 were still much better than Plots 1 and 4. Much more white clover was present, and it was also very interesting to observe that there

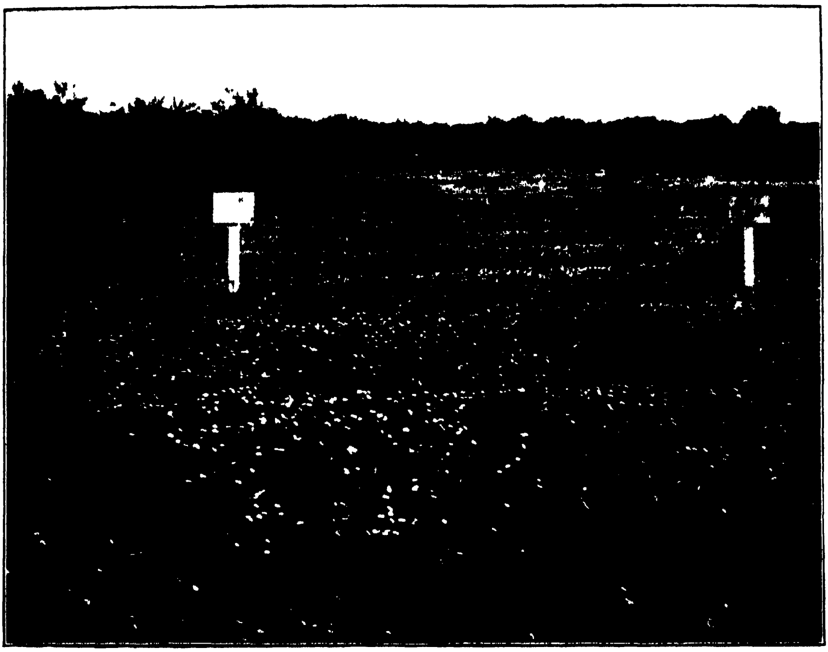

FIG. 1.—Shadingfield Plots. *Left*, No Manure ; *Right*, 800 lb. Basic Slag (100 lb. P_2O_5). The white flowers are daises, not White Clover, which will come on later.

FIG. 2.—Showing the Rough, Marshy Grassland at Scots Hall, Westleton.

were far more daisies in flower on these plots on the day of inspection.

This soil contains chalk stones. Half of each plot was dressed with one ton of lime per acre, but this has not had much effect.

Marsh Farm, Ellbough, Beccles (Mr. Wm. Bullard).—The soil is poor heavy land. On 15th March, 1920, the same manures were applied as at Shadingfield, but they have not given such a good return up to the present as at that centre. During the autumn of 1922 the following observations were made :—

Plot.

1. No manure.—Poor and weedy.
2. 800 lb. basic slag (100 lb. phosphoric acid).—Clover, better grazed.
3. 800 lb. basic slag (100 lb. phosphoric acid), 224 lb. kainit.—A good deal of clover present, well grazed.
4. 370 lb. ground Algerian phosphate (100 lb. phosphoric acid).—Weedy.
5. 728 lb. 30 per cent. superphosphate (100 lb. phosphoric acid).—Much clover present, well grazed.

These plots were ploughed up during the winter, 1922-3, and the field sown with linseed in the spring of 1923.

Little Glemham, Saxmundham (A series of trials conducted at Mr. Kirkwood's expense).—Soil part heavy and part lighter. Mr. Kirkwood applied 7 cwt. per acre of 30 per cent. basic slag to certain parts of the Park in December, 1920; in other parts a similar dressing was applied of material known as slag phosphate, whilst small areas in various parts were untreated. When inspected by a party of farmers in June, 1922, part was being grazed, and part was intended for mowing. After a careful examination of the herbage in the grazed part, it was considered that the best pasture was found on the portion manured with slag in 1920. This contained a very large proportion of wild white clover. Compared with the unmanured part it was thought that the slag phosphate had done some good, but not so much as the basic slag.

The area reserved for hay was then examined, and it was found that where the basic slag had been applied in 1920 the crop was at least doubled and was of vastly better quality as compared with the "no manure" plot. Even basic slag applied in December, 1921, had already made a considerable improvement. The party were able to pick out the unmanured patches which had been left here and there, in most cases to within a yard, and the whole inspection formed an object lesson in the extraordinary improvement caused by the application of basic slag to suitable land.

Lastly, a small area was inspected, which had received a dressing of farmyard manure, followed by a dressing of basic slag. This was being reserved for hay, and had produced a very heavy crop of beautiful herbage—in fact, the treatment was considered to be extremely suitable for this type of land when intended for hay, as the farmyard manure encourages the strong growing grasses, and the basic slag encourages the clovers.

2. **Poor Mixed Soil.**—*Corton County Council Small Holdings Estate (Mr. C. G. Cross).*—Manure applied in the winter of 1921-22.—The object of this test is, first, to ascertain the extent to which grass land of the poor mixed soil type can be improved, and secondly, what kind of dressing is likely to prove most successful. As regards the first point it was found that on all the manured plots a much larger proportion of clover was present. It seemed probable that the best plots were worth at least twice as much per acre, as far as actual feeding value was concerned, as were the unmanured plots.

As regards the effect of the various dressings applied, it might be explained that the dressings used were not heavy. They each contained phosphoric acid equal to 100 lb. per acre (*i.e.*, as much as is contained in 5 cwt. of high-grade basic slag). Four different kinds of basic slag were used—modern medium quality 24 per cent. slag, high-grade high-soluble Bessemer slag, open hearth high-soluble slag, and open hearth low-soluble slag. There were also included in the tests superphosphate, Gafsa (North African) rock phosphate, Nauru phosphate and the so-called " slag phosphate " which is a mixture of low quality basic slag and Nauru phosphate.

A careful examination of the plots in the autumn of 1922 showed that all the manures had done some good. It was observed, however, that all the plots receiving superphosphate and the highly soluble slags had been more closely grazed by the stock than others. On these plots, in fact, there was a carpet of white and red clover, quite close to the ground, and hardly any of the coarse and unpalatable grass, which was such a feature of the " no manure " plots.

It is just possible that this close grazing was partly accidental, but on the whole it seems probable that the more soluble manures had acted more quickly, and these plots had showed an improvement first. The cattle grazing the field would quickly find this out, and would go for the sweeter plots, with the result that the coarse grasses would tend to disappear by the closer grazing. Many of the other plots had shown considerable improvement over the "no manure" plots, but they had not been quite so closely grazed. A further inspection in the spring, 1923, showed that the herbage on the "no manure" plots is strikingly inferior to the rest of the field.

3. **Light Mixed Soil.**—*Woodbridge* (*Mr. G. Barnardiston*).—Mr. Barnardiston very kindly offered to conduct at his own cost a series of plots on a field adjoining his house at Woodbridge. Basic slag alone, basic slag with kainit, superphosphate alone, superphosphate with kainit, and North African phosphate were tried. Each plot received manure costing £1 13s. 9d. per acre in the winter of 1921-22.

The land is of a difficult type on which to encourage the growth of wild white clover, especially with such weather conditions as prevailed in the early months of 1922. When inspected in June, none of the plots showed much evidence of improvement. It is worthy of note that the improvement of pasture land almost entirely depends on the growth of wild white clover, and this can only take place providing sufficient moisture is present. For this reason the improvement of grass on light mixed soil is a difficult matter.

4. **Marshland.**—*Scots Hall, Westleton* (*Mr. J. W. Rickeard*).—Manures sown November, 1921. The marshes are adjoining the sea. In each case the manures were arranged to cost £1 13s. 9d. per acre at the time of sowing.

Plot.

1. 11¼ cwt. basic slag (92 lb. phosphoric acid).
2. 6¾ cwt. basic slag (55 lb. phosphoric acid), 3¾ cwt. kainit.
3. 7½ cwt. superphosphate (115 lb. phosphoric acid).
4. 4½ cwt. superphosphate (69 lb. phosphoric acid), 3¾ cwt. kainit.
5. 363 lb. Nauru phosphate (137 lb. phosphoric acid).
6. 4½ cwt. slag phosphate (115 lb. phosphoric acid).

The marsh was covered with small rushes and is rather wet. During the summer of 1922, a great improvement was to be seen on some of the plots, and large quantities of wild white clover and wild red clover grew up amongst the rushes to a height of several inches.

After a rather prolonged examination of the plots, the party of inspection during the summer came to the conclusion that Plot No. 1 was the best. This plot showed a great improvement over the adjoining land which was unmanured. The wild white clover and wild red clover were growing up amongst the inferior herbage in a most encouraging manner and the weight of the crop on this plot was estimated to be double that on the "no manure" plot.

The second best plot was thought to be No. 3, which received 7½ cwt. of 30 per cent. superphosphate. This plot also contained a large proportion of white and red clover, and showed that should our sources of basic slag fail us, superphosphate would answer extremely well, on even such unpromising places as the marshes. The third and fourth plots in order of merit, as judged by appearances, were No. 2 and No. 4. Plots 5 and 6 were distinctly better than the "no manure" plot.

Sanders Hill Marsh, Scots Hall, Westleton.—The manuring per acre was as follows:—

Plot.

1. 11¼ cwt. basic slag.
2. 6¾ cwt. basic slag and 3¾ cwt. kainit.
3. 7½ cwt. superphosphate.
4. No manure.
5. 4½ cwt. superphosphate and 3¾ cwt. kainit.
6. 363 lb. Nauru phosphate.
7. 4½ cwt. slag phosphate.

The grazing marsh was selected because of the extreme coarseness of the herbage, which consists largely of sedges, rushes, and wild iris, growing 2 ft. or so in length. A careful examination in June, 1922, however, revealed the presence of wild white clover, with large leaves at the end of long leaf stalks which had grown to an unusual height in order to enable the leaves to reach the light. The various manures given above had been applied to this most unpromising herbage, and it was thought that both the basic slag and superphosphate had made some improvement. It was considered, however, that the wild white clover had not a chance to develop properly owing to the heavy top-growth. Mr. Rickeard now proposes to keep the top-growth cut off. When inspected at the end of November, 1922, the whole had been cut and grazed quite closely. These plots should prove very interesting during the coming season.

Marshes, Hall Farm, Rushmere, Lowestoft (Mr. John Oldrin).—This marsh land is on the banks of the Hundred River. The soil is a sandy peat evidently containing a large proportion of vegetable matter. At present a considerable proportion of the herbage consists of rushes, and Mr. Oldrin has been trying the interesting experiment of running a plough, with a wide share, with a special wing attached, to cut 14 in. wide under the turf. The breast is removed from the plough and the turf is allowed to fall back to the place from which it was cut, and is then rolled down. A careful examination by a party of farmers in July, 1922, of the strips treated in this way showed that they contained a considerably smaller proportion of rushes, even when three years had elapsed since the treatment. In the case of land similarly treated in the autumn of 1921 it appeared that the bulk of the herbage was slightly reduced but the quality was improved. The strips of land were cross-dressed with various manures so that it was possible to observe the effect of the manures both on the ploughed and unploughed portions.

It had been arranged that each manured plot should receive manure costing £1 18s. 9d. per acre. The manure was not applied until March, 1922, so that the slower-acting manures had not had time to act. A careful examination of the herbage led to the conclusion that all the manures had done some good, when compared with the "no manure" plot. In all probability the two best plots were No. 3 receiving 7½ cwt. 30 per cent. superphosphate per acre, and No. 5 receiving 4½ cwt. 30 per cent. superphosphate and 3¾ cwt. of kainit per acre. Most members of the party considered that No. 5 was slightly the better. Certainly the weight and quality of the herbage on these two plots had been very considerably increased. Of the remaining plots, No. 1 which received 11¼ cwt. 16 per cent. basic slag, and No. 2 which received 6¾ cwt. 16 per cent. basic slag and 3¾ cwt. kainit per acre were decidedly better than the "no manure" plot although, having been applied in the spring, the basic slag had not had time to act properly. Plots No. 6 which received 368 lb. of Nauru phosphate and No. 7 which received 4½ cwt. slag phosphate per acre, were also considered better than the "no manure" plot, although the dressings also had not had time to act. The plots should be very interesting in 1923 and 1924.

On the whole it would appear that much improvement of marsh land of this type can be effected by the application of superphosphate or basic slag, and that clover can be encouraged to grow in a really surprising manner by the use of these manures. In the case of sandy peat, it may pay to add some kainit, sylvinite or other potash manure to the phosphatic manure, but that is a matter to be tested in each case.

Marshland at Trimley (Mr. C. C. Smith).—These marshes differ from many Suffolk marshes in that the soil is covered by a thick mat of undecayed vegetable matter. In some places this mat is two or three inches thick, and it is only soaked by rain with great difficulty. About ten years ago a number of plots were laid out by Mr. Smith at his own expense on the two marshes. The manures used included farmyard manure, basic slag alone and in combination with muriate of potash, superphosphate alone and in combination with muriate of potash and ground lime. Ground lime was also used alone.

On the first marsh some improvement was evident where the phosphatic manures were applied. None of the manures succeeded in getting rid of the thick mat of vegetable matter, although they encouraged the growth of clover to some extent. On the far marsh where the mat of vegetable matter is very thick, the improvement was not so great as on the first marsh.

The problem of getting rid of the thick mat of vegetable matter is, therefore, at present unsolved, and Mr. Smith proposes to try other methods and applications in order to see whether it is possible to effect a greater improvement in these marshes.

Dr. J. A. Hanley, of Leeds University, who inspected these marshes in June, 1922, thinks that a dressing of crag or chalk, would greatly benefit them, as the thick mat of vegetable matter is, in his opinion, due to lack of lime.

Lyons Farm, Bulcamp (Mr. W. C. Mitchell, Agent).—The cost of this experiment was borne by the Earl of Stradbroke. The soil is black, containing much vegetable matter, the herbage being largely rushes. The original experiment was started on the marsh near Bulcamp Workhouse in March, 1920.

The following observations were made after an inspection by farmers in June, 1922:—

Plot.

1. No manure.—Very poor, and full of rushes.
2. 800 lb. 28 per cent. basic slag (100 lb. phosphoric acid).—A great improvement; much clover present.
3. 800 lb. 28 per cent. basic slag, 224 lb. kainit.—A great improvement; much clover present.
4. 728 lb. 30 per cent. superphosphate (100 lb. phosphoric acid).—A great improvement; much clover present. This plot showed improvement first.
5. 370 lb. ground rock phosphate.—Very little better than the "no manure" plot in 1921. Improved in 1922.

The plots were cross-dressed with 1 ton of lime per acre, but this has not done much good up to the present.

A meeting of farmers was held on these plots in 1921, and they considered the results extremely interesting, and at their request a further experiment was arranged on an adjoining marsh, the manure being applied during the winter 1921-22. This second series of plots was inspected in June, 1922, when it was found that some of them contained a perfect carpet of white clover several inches deep. The best plots were those receiving basic slag, basic slag and kainit, superphosphate, and superphosphate with kainit. All this latter series of plots received 150 lb. of phosphoric acid per acre. These plots should prove an interesting study for some years.

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THE HILL SHEEP FARMS OF NORTHUMBERLAND.

J. ROBSON.

THESE farms occupy practically all the land lying between 500 ft. above sea level and the top of Cheviot, which stands at 2,676 ft. All kinds of weather are met with. An old saying is : " Little kens the guid wife of the trows how the wind blaws on Windy Gill." If there is such a variety of weather on one farm, one can understand the changes which are encountered between the Durham boundary and the North Sea. A variety of herbage is met with, heather, flow and bent predominating south of the North Tyne, but further north finer grasses are sometimes found. As I am not a botanist, I cannot describe all the plants which comprise a good hill pasture, but the more it is mixed, the better it is counted. The deeper the soil, the bigger the sheep it will produce; and there must be a certain amount of fine grass along the burn sides to make big fat lambs.

There ought also to be a small proportion of heather to provide a change of meat and a healthful tonic, also some flow ground on which the draw-moss (*Eriophorum vaginatum*, L.) and deer's-hair (*Eleocharis cæspitosa*, Link) grow. If the " Flows " lie fairly low so that stock are not prevented grazing on them in stormy weather, their situation is ideal. There can be too much of a good thing, and though too much mowing makes for waste land, a little is invaluable.

In a really bad spring stool bent (*Juncus squarrosus*, L.) is often the only green thing that can be found, and a little of it comes in very useful for the flock. However, it is generally found on hard, bare land, and too much is not desirable.

White Bent (*Molinia cærulea*) is unfortunately too common. Its life as a food is so short that it is only available for sheep for about three months. Thus one scarcely ever sees it on a good farm. It is greatly benefited, and its useful life prolonged, through heavy eating by cattle, but as it can only be stocked with them in June, and they should be away by September, it is scarcely a profitable business buying them for that short period, especially as that is the time when grass everywhere is generally most plentiful.

Breeds.—Only two breeds of sheep are found, the Cheviot, indigenous to the district, and the Blackface. The former was thought so much of that in 1703, Sir John Sinclair, when taking sheep to the North of Scotland, came to Northumberland for a selection. A century ago, Blackfaces were unknown in the county, but with the demand for younger mutton, and the low price of wool combined with a run of bad seasons, this breed began to replace the Cheviot, till now they are perhaps as numerous.

Stocking.—The farms range from 500 to 10,000 acres with a sheep stock of 100 to over 3,000. On an average a shepherd will have a " hirsel " of 600 sheep. and his " hill " will extend to anything from 500 to 2,000 acres. One sheep to the acre is usual on the better land, but as much as three acres per sheep may be required on the poorer grazings.

Formerly shepherds were paid " pack " wages, that is, they were allowed to keep so many sheep, from fifty upwards, along with the employer's, and the increment from them was his wage, but packs are very scarce now, and the shepherds are generally paid in cash, with a free house, potatoes, coals carried free, and the keep of two cows. The pack system caused a good deal of extra labour in sorting, all the pack sheep having to be sorted by themselves. Of course, this was payment by results, but just as much care is taken one way as the other, and in fact the only shepherd who ever left the writer in the lurch had a pack wage and left his own sheep behind.

Management.—The management of the two breeds is practically the same, so one description will do for both. We will take the season as beginning about 20th November, when the tups are put out, one tup to 60 or 70 ewes, and during the time they are out. about ten weeks, the ewes are gathered to each tup. A few extra tups should always be provided to replace any that go wrong. About the New Year they are brought in, and usually sent away to turnips, unless these are grown on the farm. After that, should the weather be favourable, is the shepherd's easiest time, as less herding is required then than at any other season. The shepherd must always be on the alert in case a sudden snowstorm should arise, when the sheep must be gathered to the stells. This may be a very trying time, as, if the flock be caught out, it is very hard work indeed getting them collected. so much so that some men have become so exhausted that they have succumbed to the exposure.

That sheep farming is not all beer and skittles was proved by the spring of 1917, when in spite of every attention thousands of sheep were lost. The year 1860 was also a disastrous one; on one of the best hill farms in the county only 220 lambs were weaned from 1,400 ewes. The "eighties," also, took a heavy toll from border farmers.

Calamities such as these leave their mark for many years, not only on the bank balances of the stock owners, but also on the stamina of their sheep, for the survivors, though no doubt the strongest, suffer in hardihood.

A bad lambing time, too, by causing a short crop of lambs, compels farmers to retain as breeding stock many smaller and poorer lambs which in the ordinary course would have been drafted.

A snowstorm is a great test of a shepherd's ability, as some men have the knack of looking after their flocks so that they exist much longer without hay than others can. In such seasons the shepherd's work is arduous as well as disappointing, for in spite of all he can do, his charges deteriorate in condition. When hay is required there should be a daily allowance to each score of sheep of about a stone of the best hay scattered on a piece of well-sheltered ground which should be changed as often as possible. On some farms, benty or grassy ones as a rule, once haying is commenced it is continued as long as it is eaten. In this case it is given in hicks or nets, and care should be taken that the sheep are not allowed to lie about the nets after they have eaten up the hay. As the season wears on a sharp look-out must be kept for any lean sheep, and these should be brought into the fields or sent away to better grass. About the beginning of April it is customary on some farms to udderlock all the ewes as it is thought that the lambs suck more readily and there is less danger of the lambs getting wool in their stomachs.

With such flocks ewes are lambed on the hill, and not brought into enclosures as in other parts. Lambing begins about mid-April, and each shepherd is generally provided with a lambing man whose assistance he has for a month. Before he leaves, the lambs should be marked, their tails cut, and the wedder lambs castrated, those intended for tups having been selected first. Castration can be done in many ways. The oldest and simplest is by the knife, the other of the more commonly practised methods being by the clamps and a hot iron. In the latter case the operation is generally deferred till the end of June and is commonly practised on "diseased" farms. At the end of June sheep are washed by being swum through a pool a few times, but Blackfaces are seldom washed, and many Cheviots are now clipped in the grease. Clipping takes place in July—Cheviots about the beginning, Blackfaces later. This should be carefully done, the wool nicely trimmed and the fleeces neatly tied by ropes made by twisting a piece of the fleece.

On the eastern borders, Cheviot ewe lambs for stock are weaned about the end of July and sent to their hogging where they stay for two years and are then brought to the ewe "hirsels" to take the place of the ewes sold as drafts at five years old. Further west and amongst Blackfaces, the keeping ewe lambs generally follow their mothers and have lambs a year younger—at two years. The wedder lambs are sold at the auction marts at the end of August and are bought by feeders to be fed off. Blackfaces are often sent straight to the butcher, and many who practice this method do not cut their lambs but sell them as tups in August and early September. If kept, they should be cut later.

The summer dipping should be done in August and a fly dip is generally used at this time. Cheviot draft ewes should be dressed and brought out in as good form as possible for the draft ewe sales held early in October. Blackfaces should be dipped in a bloom dip and brushed up, not dressed like Cheviots. As soon as the drafts are away, the second dip should be used. After this, dosing the hoggs, if it is practised, is the next work, and we complete our cycle with heeling—marking with a coloured paint, at which period it is advisable to select the best ewes to put to the best tups obtainable.

During the whole year a constant lookout should be kept for lame sheep and any showing the least symptoms of lameness brought in, the feet pared, and dressed with a good paste. After dipping, some flockmasters drive their sheep through a footrot trough containing a mixture of a proprietary article, arsenic, or bluestone; this is a great preventive of footrot, but should not take the place of the foot dressing previously mentioned.

Maggot flies are much more troublesome now than they used to be, and a constant watch should be kept for them. If very bad, dipping the whole flock is advisable, as for a time it keeps the fly off.

If the shepherd takes a real interest in his flock, his duties, though necessarily of a routine character, can never be monotonous, as such work certainly would be to anyone who simply did it for his daily bread. To rise at daybreak, climb to the top of a hill, often rising one thousand feet above his cottage, turn his sheep in, then come back above them again to see that none are left lying back or are amiss in any way, may mean a walk of six to ten miles—determined by the extent of ground which comprises his "hirsel." His time is then his own—unless he finds some of his flock require special attention—till the afternoon, when he takes a turn round the lower part of his ground, turning his flock out so that they go to the hill tops for the night, except in stormy weather, when they are allowed to lie on the lower and more sheltered parts. A good shepherd should, as we are told, know his sheep, and although I am doubtful if the sheep know him, they certainly know his dogs, as anyone can see who takes strange dogs amongst them.

Shepherds have generally to help at hay time, so that season is a hard one for them, having their sheep to watch and also to be in the hayfield when hay-making is possible.

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ELECTRO-CULTURE WORK IN 1922 AND 1923.

THE following account of work on electro-culture, carried out in 1922 and to be carried out in 1923, is summarised from the Fifth Interim Report of the Ministry's Electro-culture Committee, which has recently been presented.* The previous work of this Committee was summarised in this *Journal* for December, 1922, p. 792.

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* This report will not be published, but copies may be obtained on application to the Secretary of the Committee, Mr. W. R. Black, B.Sc., Ministry of Agriculture, 10, Whitehall Place, London, S.W.1.

During 1922 field experiments were carried out for the Committee by Prof. V. H. Blackman as follows:—*Rothamsted Experimental Station*—Experiments with winter wheat and barley; *Harper Adams Agricultural College*—Experiments with cabbages, swedes, mangolds and potatoes; *Lincluden*—An experiment with potatoes. An economic installation was erected at Rothamsted. Pot-culture experiments with barley were continued at Rothamsted. Laboratory investigations were conducted at the Imperial College of Science. Electrical measurements were made to determine the influence of an electro-culture installation on the electrical conditions to leeward and windward.

Field Experiments in 1922.—Seven experiments were carried out during the year, two with cereals, two with potatoes, two with root crops and one with cabbages; two of these gave a positive result and five a negative result. The season was not a favourable one for experimental purposes, the yields of the cereals being abnormally low, that of wheat being only about half the average. In the case of the root and cabbage crops, owing to the doubt which exists as to the satisfactory nature of the cultural conditions, the Committee are of opinion that no safe conclusions can be drawn from the experiments, and that the results should not be included in future records.

For an account of the field experiments in detail reference must be made to the Committee's Report.

Pot-Culture Experiments of 1922.—Ten experiments were carried out with barley in 1922 and were mainly designed to obtain further knowledge as to the stage of plant growth during which the discharge can most advantageously be given, and the most suitable daily duration of the discharge. An experiment was also carried out to determine the effect of the normal atmospheric current. In all the experiments grain yields as well as total yields were obtained.

The discharge was applied (in different experiments) in the first month, the second month, and the third month of the growing season respectively, and also throughout the whole three months; in the case of each period the discharge was applied (in different experiments) for six hours and also for one hour daily.

Definite increases of yield were obtained in all the experiments but one, in which the plants were attacked by mildew. The increases in dry weight reached 39 per cent. in one experiment, but in other cases were quite small. In all cases, however, with the exception already mentioned, very marked increases in *grain* yield were obtained, reaching even 118 per cent., and these large increases in grain yield were usually associated with very small increases in total yield. The effect is so marked that it establishes a differential action of the discharge—that of accelerating reproductive growth apart from vegetative growth, an effect hitherto unsuspected.

Another striking result was the marked effect on grain yields of comparatively short periods of discharge. Electrification for the first, second and third month, respectively, of the growing season gave in all cases large increases of grain, the second monthly period being the highest of the series with a yield more than double that of plants not subjected to the discharge. How far such a large increase may be expected in other seasons remains to be determined.

In one experiment plants were subjected to a discharge of a lower intensity than any hitherto employed, the current being only about 100 times the value of the normal atmospheric current. This current, which was continued for the full period, was apparently as effective as the stronger current, except in the case of plants electrified for the second month.

The removal of plants from the influence of the normal atmospheric current was accompanied by a slight reduction in yield.

The pot experiments are referred to in detail in the Committee's Report.

Economic Installation at Rothamsted.—A field installation was erected on Fosters Field at Rothamsted in 1922 on an economic scale (*i.e.*, with poles spaced widely, and with high wires, so that no undue interference was caused to farming operations), the object being to determine the kind of installation suitable for the purpose, the current required, and the cost.

The area under the influence of this installation (assuming the discharge to be effective for 15 ft. beyond the wires on all four sides) is about 5 acres. The installation consists of 9 creosoted poles each 24 ft. in length, of which 6 ft. is sunk in the ground; 4 of the poles are in the field and 5 in the hedges. The supporting wires at the ends of the area and in the middle of the area are of rustless mild steel (No. 12) each 125-150 yards long. There are 12 thinner wires (No. 26) of silicium bronze, each 200 yards long. The porcelain rod insulators are 18 in. long. The cost of the installation and its erection (materials, carriage, labour, travelling expenses and supervision) was £52, or about £10 per acre.

The Agricultural Electric Discharge Company have supplied the Committee with estimates of the cost of erection of an economic installation in areas of various sizes. The cost of the poles, insulators, and wires for 100 acres is £215, *i.e.*, slightly over £2 per acre, so that it is obvious that the price for small installations is no criterion of the cost in actual practice. The fact that fields are not of the size of 100 acres hardly affects the question since several fields can be included in one installation.

Electrical Measurements, 1922.—The measurements were taken at Rothamsted (1) on the wheat plot, (2) on the stubble after the wheat crop was removed, and (3) on the field under the economic installation.

Before these experiments doubt might well be entertained whether even a rough estimate of the current passing to the crop could be derived from the measurements of the current passed into the overhead wires. It now seems fairly certain, however, that with overhead wires whose distance apart is not much in excess of their height, fully half the current supplied to the wires may be expected to reach the crop. It is also clear that a very considerable area surrounding the electro-culture area, especially on its leeward side, receives a discharge much in excess of that which passes normally between air and earth.

The Committee's Work in 1923.—The results obtained in 1922 indicated the importance of concentrating attention on pot-culture experiments, small plot experiments and laboratory work. The experiments of 1922 on the effect of the discharge during different growing periods and different daily periods are being repeated in 1923; the effect of very weak currents and the effect of screening the plants from the normal atmospheric current are again being studied.

The results obtained from pot experiments are not always reproduced in the field owing to the effect of subsoil and other factors. Small plot experiments are, therefore, being carried out at Rothamsted and Lincluden for comparison with the results of the pot-culture experiments; the discharge is being applied for three different periods:—one, two, and three months respectively.

The economic installation at Rothamsted is being used for crop electrification, and measurements will also be made of the electrical conditions in and under that installation.

It has been found that the effect of the current is greater a short time after the application of the discharge has ceased than during the period of the discharge. Laboratory experiments are therefore being carried out to ascertain the minimum period of electrical stimulation giving the greatest after effect as exhibited by an increase in the rate of growth.

Work on a field scale is being suspended during 1923, except for small plot work and the collection of data from the economic installation.

The results obtained from pot-culture work in 1922 are important, *inter alia*, from the point of view of the installation required on an economic scale. If it were necessary to apply the discharge for one month only, a very temporary installation could possibly be used, with consequent reduction in cost. Different fields could possibly be treated with the same installation. With lower heights of wires a lower voltage would suffice, and it might even be possible to apply the discharge by means of apparatus comparable to a " Knapsack Sprayer " or some ordinary agricultural implement. The Committee are keeping this aspect of the question in view.

Future Work of the Committee.—It is clear that the electro-culture problem is an intricate one with both physiological and agricultural aspects, and one which is far from being fully elucidated. The Committee's investigations, however, may be fraught with the most important consequences to agriculture as the results hitherto attained clearly indicate.

By a series of field experiments spread over a number of years the Committee have shown the type of electrical apparatus most suitable for the production of the high-tension discharge and have also shown that an increase of 20 per cent. can be obtained with certain cereal crops. That such results should have been obtained is very striking when the poverty of our knowledge of the conditions under which the electric discharge should be applied is taken into consideration. The Committee hold that a study, by laboratory and pot-culture methods, of the effect of the discharge at different stages of the plant's growth, of the effect of different daily periods of discharge, and of different strengths of current, will throw much light on the proper conditions under which the discharge should be given in the field. The Committee are confirmed in the view by the remarkable results obtained in 1922 when in pot-culture experiments an increase of 118 per cent. was obtained with only a single month's electrification.

Such results as these are of very great promise, for if lesser increases of 40 or 50 per cent. can be obtained in the field there can be no question of the economic application of electro-culture. The Committee therefore propose in the year 1924 as in 1923 to confine the work to pot-culture and small plot experiments, and to laboratory investigations. It is proposed, however, that in 1925 field experiments shall again be undertaken on the basis of the scientific knowledge acquired in the previous years. The Committee expect by the end of 1925 to have made very definite progress in knowledge of electro-culture, and a definite advance towards its practical application.

The Committee understand that a period of 20 years was required to complete the investigation into a systematic application of fertilisers. The electrical problem appears to be even more complex, but from the results already obtained the Committee believe that positive and economic conclusions will be reached within a much shorter period than the problem of fertilisers required if investigations are carried on continuously.

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GRADE "A" MILK—IS IT WORTH WHILE?

F. A. Cox.

In the hope that the matter may be of interest to others who feel inclined to embark on the same procedure, an attempt has been made to give here a description of the alterations in equipment and methods on my farm near Oxford, which has recently diverted its energies from the production of ordinary to Grade A (tuberculin-tested) milk.

To begin with, our experience of the tuberculin tests may be interesting, perhaps encouraging, to others. Two reactors only, in a test of twenty-five, were found on the first occasion, and six months later a purchased heifer reacted to the eye test. These animals have been removed. This result, it will be agreed, was highly satisfactory, and we were then well prepared to proceed with the necessary modification of the buildings, a description of which follows.

Milk Room.—Methods under the old system were probably similar to those obtaining on a good many farms. Cooling was done in the scullery attached to the farm house. This state of affairs obviously could not continue. Cooling and washing up needed to be done in a separate building, and accommodation found for a steam boiler for sterilising purposes. Before anything was decided on, it was considered advisable to see the arrangements existing on other farms, and a visit was paid, under the auspices of the National Institute for Research in

FIG 5 —Interior View of Dairy showing Washing and Sterilising Arrangements

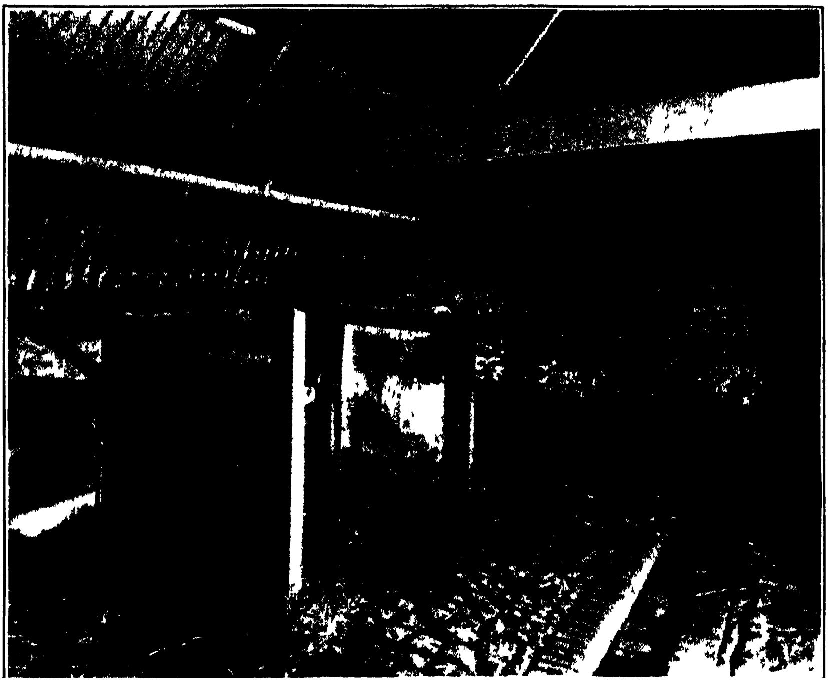

FIG. 6.—Showing the Interior of Shed before Re-construction.

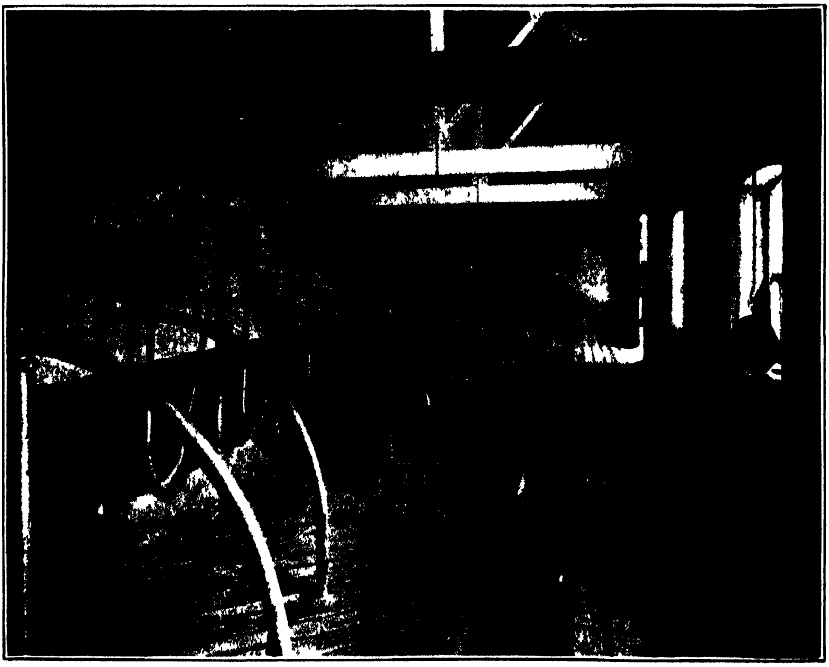

FIG. 7.—Interior of Shed after Re-construction.

Dairying, to those near Reading described by Major H. P. Maule last year.*

After looking round for a suitable building for conversion into a milk room, it was decided to commandeer the domestic coalhouse—at first sight a most uninviting place. Imagine a substantial stone building practically devoid of light and measuring inside 15 ft. by 8 ft. 6 in. Fig. 1 is a plan showing details of the alteration made here. Glass slates in the north side of the roof were the easiest solution of the lighting difficulty. A concrete floor was laid, and a slab partition put up dividing the building into two rooms approximately 7 ft. 6 in. by 8 ft. 6 in. That with direct external access was fitted up as a washing and sterilising room. Fig. 5 shows the equipment of this room, with washing up trough and steriliser, with the necessary steam and water fittings. The steriliser is of a new type, built of brick cement plastered, and fitted with a wooden lid. A drainage hole is situated at the bottom, and no attempt has been made to make the steriliser steam-tight. Dimensions are 7 ft. 6 in. long by 2 ft. wide by 3 ft. high, giving ample room for about five twelve-gallon churns and cooler, buckets, filter, etc., at once. This steriliser, besides being inexpensive, has proved very efficient, no difficulty having been experienced in getting the necessary temperature of 210° F.

The other room was fitted up for cooling purposes, the cooler being supported on irons let into the wall. A bucket rack of galvanised pipe was fitted, but is little used, as it is found more convenient and satisfactory to leave the utensils in the steriliser till required.

All walls were cement plastered to a height of 5 ft., the roof covered with match-boarding, and angles between wall and floor rounded out. Whitewashed walls and the provision of a drain completed the necessary work here.

The boiler (Fig. 1) is housed some distance from the milk room, being connected thereto by some 40 ft. of pipe, lagged to prevent loss of heat. The building housing the boiler is a hog-tub house, an old copper being removed to make room, and the boiler is available for steaming pigs' food as well as sterilising, if necessary. The boiler was obtained cheap locally, this fact enabling us to keep the cost of the milk room and sterilising equipment down to the reasonable figure of about £60.

Cowshed.—This is situated some twenty yards from the milk room. Fig. 6 shows the appearance of the old shed, Fig. 8

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* This *Journal*, Sept., 1922.

being a section of the same place. It had few redeeming features, with the exception of the fact that the building itself was substantial and sound. Cobble floor, high mangers, standing too long, insufficient lighting, bad drainage, are all objectionable. Fig. 7 shows the shed after alteration, the dimensions being given in Figs. 2 and 4. The roof is of double Roman tiles, and glass tiles of the same section were readily obtained and formed an easy means of improving the lighting. Some thought had to be expended on Fig. 4 before satisfactory dimensions were arrived at, the shed being a rather narrow one (15 ft. only), for the inclusion of a feeding passage. Had more room been available the gutter would have been 2 ft. instead of 14 in., and the manger 3 ft., as we find the cows are inclined to drop some food over the manger back into the passage. The fittings used are British and cost £2 10s. per cow. The mangers are built up of slabs, cement plastered, and the divisions have an opening at bottom to permit of flushing the whole range from end to end. All angles in floor and manger are rounded out to provide no lodgment for dirt, and the back wall is cement plastered to a height of about 8 ft. to facilitate cleaning.

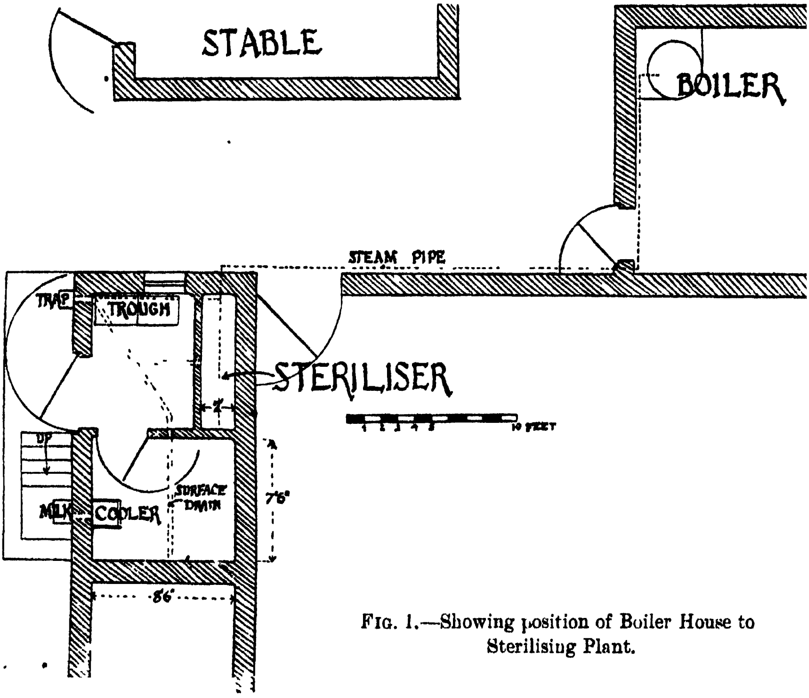

FIG. 1.—Showing position of Boiler House to Sterilising Plant.

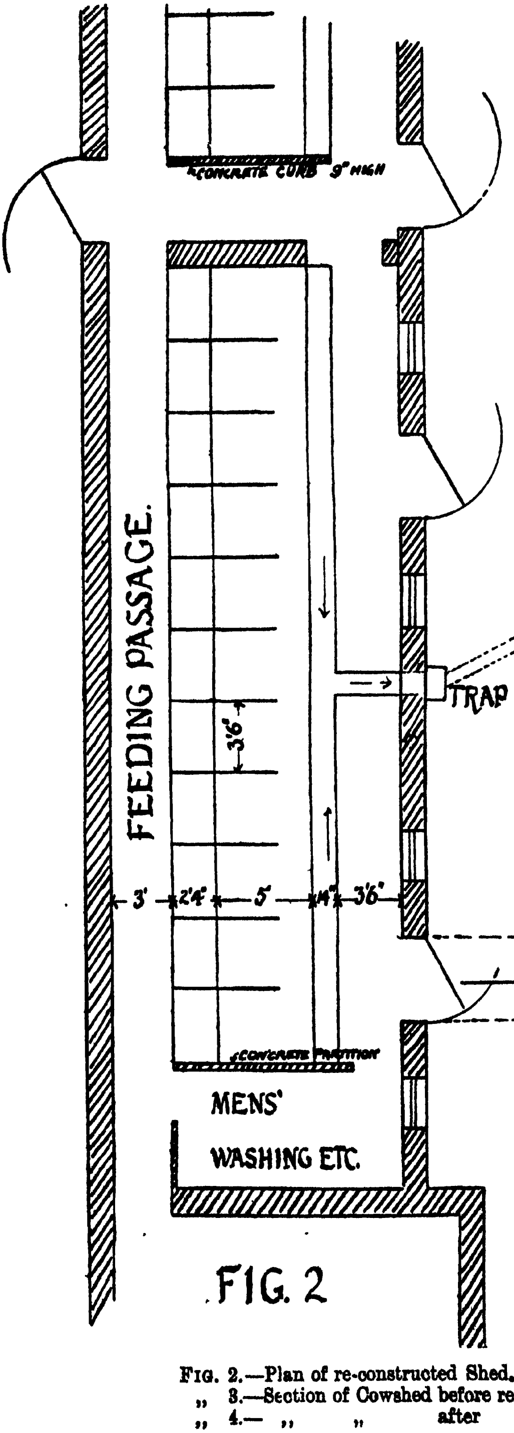

FIG. 2

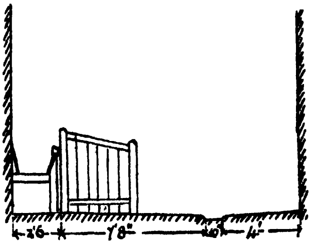

FIG. 3.

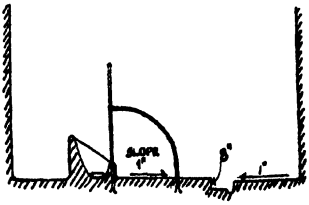

FIG. 4.

FIG. 2.—Plan of re-constructed Shed.
„ 3.—Section of Cowshed before re-const
„ 4.— „ „ after „

Ordinary farm labour only was used throughout this work, and while the appearance may not be equal to that of the best professional work, the result is quite satisfactory. Unfortunately no account was kept of time put in on the work, but as near as can be estimated the total cost, including fittings, of conversion of this shed was approximately £5 10s. per cow, a very reasonable figure.

Fig. 2 also shows the arrangement that is being adopted to provide accommodation for milking suits and for washing men's hands : two stalls at the top end of the shed are dispensed with, a partition dividing this portion from the remainder of the shed.

Drainage of these buildings was a comparatively simple matter, as a system of sorts was already in existence, and also a liquid manure tank. This system was overhauled and new drains from the cowshed and milk room were connected to it. All drains passed through the wall into a suitable trap outside.

In conclusion, a few remarks on the practical aspect of the production of Grade A milk will not be out of place It is recognised that the cost of production is greater than that of ordinary milk. Certain charges cannot be avoided, such as interest on capital outlay in conversion, veterinary surgeon's account, etc., but actual running expenses can be kept down by careful management. For example, with a slight readjustment of labour it has been found possible to produce Grade A milk from this herd of some 20 cows without any increase of staff. A small amount of extra time is involved, which would mean, roughly, 5 men, or 4 men and a boy, where 4 men sufficed under the old conditions. It has always been the practice on this farm to wash the cows' udders, and we find in the new shed that the cows, when lying in, keep themselves much cleaner than previously, and little labour is required in cleaning them.

Economy in boiler fuel is possible by the method adopted here. Utensils are washed in cold water after the morning milking. The boiler fire is lit about 11.30, and steam is usually available after the dinner hour, when the utensils are thoroughly scoured, rinsed and steamed. The fire is then damped down to keep the boiler in readiness for the afternoon steaming. By this means the boiler is only hot for 6 hours a day and fuel consumption is kept at a minimum.

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STRAW ROPES AND STRAW ENVELOPES—THEIR MANUFACTURE AND USES.

Communicated by the Rural Industries Intelligence Bureau, 258, Westminster Bridge Road, London, S.E.1, where reprints can be obtained.

A DESCRIPTION of some of the industrial uses to which straw is put and the methods adopted in preparing it, may be of interest to many, who perhaps have not realised the importance of straw to a number of different trades. The practical economy of any process which will increase the value of the raw article and which at the same time should make it both easily marketable and provide useful employment in the country will be quite apparent.

I. STRAW ROPE.—Of the two processes to be dealt with in these notes, the production of straw rope is simpler, perhaps more remunerative and better suited for unskilled labour than the manufacture of straw envelopes.

A. Its Uses.—1. *As a Packing Material.*—Furniture and bedstead makers, electric conduit tube makers and brass and copper tube manufacturers all use straw rope as a packing material to protect the enamelled, polished or lacquered surfaces. Straw rope is also used in the packing of fragile goods, pottery, glass ware, enamelled hollow ware and stone ware. Again, coils of barbed wire for export are frequently covered with it—not as protection to the wire, but to enable it to be handled easily and to prevent damage to other goods in contact—and chemical manufacturers use it for surrounding carboys, etc.

Straw rope is also sometimes employed in chemical and other factories as a cheap form of lagging for boilers, steam pipes, hydrants and exposed piping, when they are not exposed to undue risk of fire. This use is, however, much more common on the Continent than in England. When required for boiler lagging, the rope is made as large in diameter as possible; it is then coiled tightly round, driven close and afterwards covered with about 2 inches of clay or marl, mixed with chopped straw, grass or other dried fibre in order to prevent the caked clay when dry becoming detached in a mass. A little teased-out hemp is also a very good thing to mix in with the clay.

2. *In the Foundry Trade.*—Straw rope is also a great deal used in the foundry trade chiefly for large and heavy work, as a

corebinder and occasionally as a mould stiffener. At one time it was part of the regular work of the coremaker to twist up the straw by hand into rough ropes as required. Nowadays, it is cheaper and more satisfactory to buy it ready spun, and a good deal is imported for this purpose, which could be made quite as well and as cheaply in this country. Some large iron foundries, however, possess their own rope-making plant.

For large work, rope about 1¼-1½ in. in diameter is chiefly used. For smaller or more complicated cores, straw is not so suitable as wood wool rope which is often employed in spite of the fact that it is more expensive. Indeed, for many or all of the industrial uses outlined above, wood wool is probably a better article to use than straw, but as the rope can seldom or never be retained for use over again, the cost of the latter is frequently prohibitive.

3. *For Straw Mats.*—The machines used for spinning straw ropes can also be used for rush and reed ropes used in the making of coiled rush mats; and the installation of one or two machines might be of great advantage to an existing industry of this sort. There is no particular reason why straw should not be used in making mats of this kind to a greater extent than is done at present, and there might well be an opportunity here for the establishment of a promising village industry. Such mats should command a ready sale, as the cost ought not to be more than one-third to one-fourth of the cost of coir mats.

For mats, *rye straw* spun into ropes from ½-¾ in. in diameter is the best. Sewn together with fine twine and backed with Hessian, the mats could be made up in a flat coil either round square or oblong in shape. In order to introduce variety and to improve their market value, the straw could be dyed before being made into rope.

4. *On the Farm.*—On the Continent, the farm uses of straw rope are generally recognised and a special type of spinning machine for agricultural uses is on the market; the machine is usually hand operated, but can be had adapted for power drive. This machine makes straw ropes in short lengths up to 7 feet in small diameters of say ½-¾ in.; and by using this, the farmer can for many or most purposes save the expense of binding twine. For thatching and ricking, the use of straw ropes often means a saving of time and labour as well as an improvement in appearance.

The sizes and quality of straw rope required in industry vary greatly according to the purpose for which they are needed; ⅜ in.

diameter is about the smallest that can be satisfactorily produced, and 1½-1¾ in. diameter are about the largest that are normally required, although larger ropes than these are occasionally made. The larger sizes are chiefly used in the heavy iron foundry trade, which often requires a hard rope—from 1-1½ in. in diameter. Wheat straw is useful for this purpose, or barley straw when a softer rope is demanded. Makers and exporters of lead ware, such as pipes, guttering, etc., prefer a very soft rope of about the same size, and for this, barley straw only would generally be used. The sizes most generally in demand are ½ in., ¾ in., 1 in., 1⅛ in. and 1½ in.

B. Varieties of Straw.—1. *Oat Straw*, owing to its value as a food, would not perhaps be used to any great extent, but, when available, it is suitable for making very good quality medium hard rope. It is best suited for sizes say ¾-1 in. in diameter.

2. *Barley Straw* is about the best of all for making rope for packing purposes. In diameters of ¾ in. to 1½ in. it makes a very soft rope; it is not very satisfactory for making the smallest sizes of ⅜-½ in., but ½-in. ropes can be made quite well if the straw is of good quality. As barley straw is cheap, and has not so great a value for farm purposes as other kinds, it can probably be generally employed with advantage in rope manufacture. The difficulty with this straw is that it is often too short to make a strong rope.

3. *Wheat Straw* being rather brittle, is not satisfactory except in ropes of fairly large size, *i.e.*, 1 in. to 1½ in. or over. It is best made into hard ropes such as are frequently required for foundry work, and it can also be used for lagging purposes.

4. *Rye Straw* is probably about the best straw of all to use. Most of the Continental imports are made of this, and being long and tough, it is particularly suitable for making ropes in the smaller sizes such as ⅜ in. to ⅝ in. diameter, but the larger diameters can be made from it equally well.

Little, if any, difference in price for the rope can be expected from using various kinds of straw except that a loose and comparatively weak rope from short barley straw would have a lower value.

C. Weights and Prices.—Considerable variations seem to obtain in the weights of manufactured straw ropes, as given by different authorities. These differences, however, chiefly occur in the larger sizes and are to be explained by variation in the closeness of the twist, *i.e.*, a soft loose rope is decidedly lighter than a hard closely twisted one.

The prices of imported ropes have fluctuated greatly during recent months and are at present high owing mainly to a severe Continental straw shortage. The prices given in the following tables are rates quoted for Dutch ropes in April, 1928—c.i.f. Hull, Grimsby, Goole, Leith, etc., and are for rye straw per 1,000 yards.

These ropes are consigned in 500-yard bales in the ⅜ in., ½ in., ⅝ in. and ¾ in. sizes and in 250-yard bales in the larger diameters.

The two tables are calculated on the highest and lowest range of weights which have been communicated to us.

Table I.

Diameter of Rope—in.	⅜ in.	½ in.	⅝ in	¾ in.	1 in.	1¼ in.	1½ in.
Weight per 1,000 yards, approx., lb.	30–32	45–50	65–70	90–100	180	250	358
Price per 1,000 yards	8/1	8/8	9/8	11/-	16/2	20/5	22/6
Yards per ton, approx	72,000	48,000	33,000	23,600	12,500	9.000	6,200
Value per ton. approx.	£29 2	20 16	16	12 13 4	10 2	9 3 9	6 19 6

Table II.

Diameter—in.	½ in.	⅝ in.	¾ in.	1 in.	1¼ in.	1½ in.
Weight per 1,000 yards, approx., lb.	46	62	99	154	200	242
Price per 1,000 yards ...	8/8	9/8	11/-	16/2	20/5	22/6
Yards per ton, approx. ...	49,000	36,000	23,000	14,500	11,200	9,250
Value per ton ...	£21 4	17 8	12 13	11 14	11 9	10 8

D. The Rope Spinning Machines.—To produce straw rope economically and with any hope of competing with the imported article in supplying the needs of industry, special machinery is essential. A hand-operated spinner would probably suffice for making the short lengths and comparatively small quantities required by the farmer for his own use, but power driven plant would be required for anything beyond this.

It has not been possible up to the present to obtain particulars or prices of any machines suitable for the purpose, made by English manufacturers, or even to ascertain that anything of the sort is at present on the market, but no doubt once the demand for such apparatus arose, reliable home-produced equipment would soon be forthcoming.

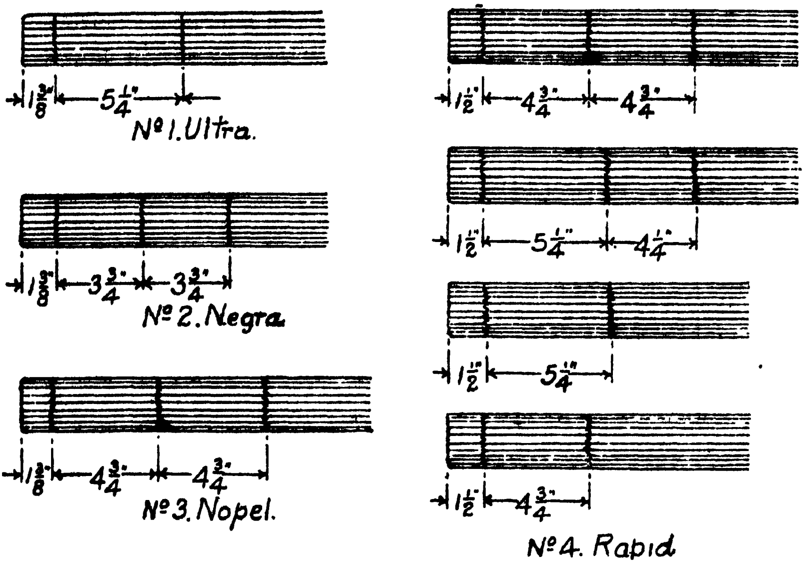

FIG. 1.—Methods of Sewing Straw Envelopes.

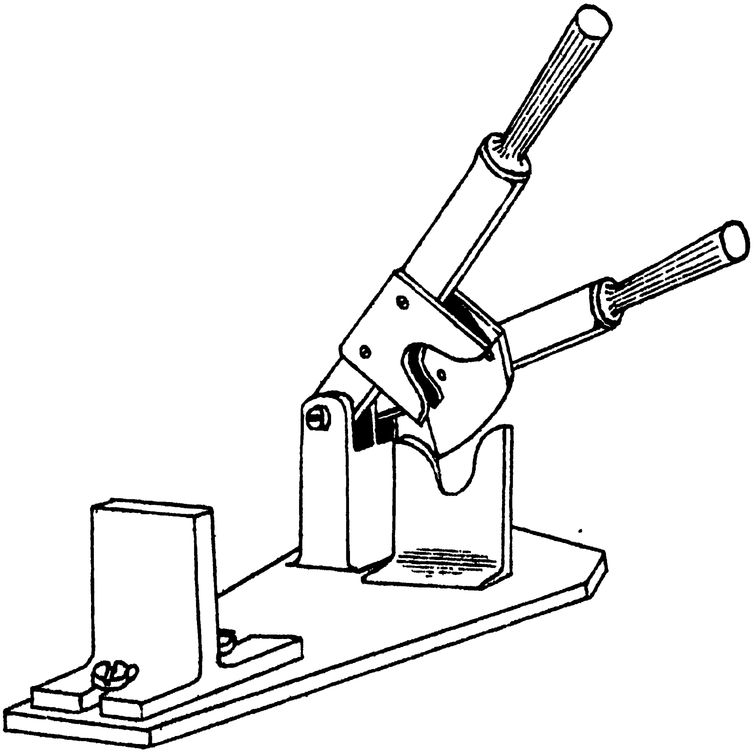

FIG. 2.—Straw Envelope Header and Trimmer—Hand-operated.

There are several patterns of Continental manufacture available. They differ little from one another except in minor details. Perhaps the simplest and most reliable of these is the "Concordia" machine, of which a general description is given below.

This type is made in 6 patterns for varying sizes of ropes:—

No.	*Capacity.*		*Remarks.*	*Approx. H.P. reqrd.*	*Revs. per min.*
	Length of Rope.	*Diameter.*			
		in.			
1.	7–8 feet	½–¾	Hand operated	—	—
2.	7–8 feet	½–¾	Power ...	0·5	50– 60
3.	Up to 250 yd. ...	⅜–⅝	" ...	0·5	40– 60
4.	do. ...	⅝–1	" ...	1·0	50–100
5.	do. ...	1–1¾	" ...	1·5	80–100
6.	do. ...	1½–2¾	" to special order only.	2·0	80–100

These machines produce ropes of two strands. The straw, which for good rope should be no shorter than 30 in. and preferably 3 ft. in length or over, is placed into two long narrow troughs, from which it is fed by hand as required. The ends of the straw are gripped by scored rollers, which carry it forward to the spinning boxes, where it receives a half twist—one layer over another. From here the rope passes across a pulley or through a guide to the forming box, which gives the rope its final twist and, if it is required, a sewing attachment fitted to the machine will automatically sew up the rope as it passes through this box to prevent it unravelling. A flattening device can also be put into action if necessary. This forms the rope, as it passes, into a more solid and compact state; but this is not needed in all cases. Immediately after this point, the rope is caught between the two ejecting rollers, which grip it and force it through a guide, whence it passes out to the winding drums upon which it is coiled. The drum or reel can be fitted with an adjustable brake, and also with an arrangement by which the rope is wound evenly backwards and forwards upon it. A device may also be attached by which a bell is rung when the reel is getting full, in order to warn the attendant to stop and change or empty the drum.

As soon as a coil is removed from the machine, the severed end should be tied to prevent unravelling. Clipping gear, for shearing off the projecting ends of the stubble which stick out as a result of the first folding over operation, is usually fitted to work between the first and second operations. It may be either in the form of a revolving knife or pairs of automatically operated shears.

A measuring apparatus, which will automatically stop the machine when a predetermined length of rope has been made, can also be fitted.

The size of the rope spun depends upon the amount of straw fed in by the operator from the troughs; and here skill and experience count in producing good firm and uniform ropes.

The output of the machines is stated to be approximately as follows, but it is doubtful whether the higher of the rates could be continuously maintained for any length of time:—

Small diameter	...	⅜–⅝ in.	about	5–8	yd. per minute.
Medium "	...	¾–1 "	"	7–10	" " "
Large "	...	1–1¾ "	"	6–7	" " "

The larger sizes will require two operators feeding in straw to give this output.

The use of the various sewing, flattening and clipping attachments does not interfere with the rate of production.

The hand-worked machine is generally similar to the power-driven one except that it has no winding-off reel. The rope is delivered on to a kind of projecting shelf and cut off when the length is reached for which the knives are set.

Present prices of machines are as follows. These are liable to fluctuation with the Continental rates of exchange.

Size	Nos. I & II	..	£43 approximately.
"	No. III ...	...	£46 "
"	No. IV ...	...	£48 "
"	No. V ...	...	£57 "
"	No. VI ...	...	On special application only.

Extras.

Stubble Clipper	...	£1
Warning Bell	...	£2
Extra Reels	. .	£1 each
Straw Cradles	...	£1 10s. per pair
Automatic Measuring Gear	...	£4

A few remarks upon points to be considered by any one proposing to instal machinery of this kind will not be out of place.

Though they may seem rather complicated pieces of apparatus, they are in reality no more so than many other machines now used on the farm, and should not require a great deal of expert attention. Unless power is already installed and used for other purposes as well it would probably not be so economic to put in one straw rope machine alone, as the overhead charges would tend to be rather high.

The amount of straw provided by, say, 300 to 350 acres of arable land should be sufficient to keep two or even three machines going and still leave enough to be reserved for ordinary farm uses. An oil engine of 3-4 H.P. would supply sufficient power. It would, however, not be advisable to put in anything much smaller for only one machine, and intermediate shafting will probably be necessary, even in this latter case, to step down the speed of the engine to that required by the rope-making machine.

The labour involved in tending the machines is not heavy, and it is quite possible to employ boys or girls. Two girls should be able to make from 2,000-2,500 yd. of ¾-in. rope in an 8-hour working day. It will be noticed that this figure is decidedly below the capacity of the machines mentioned above. Those figures given by the machine-makers, probably relate to conditions which would not obtain with the small user, who would not, as a rule, employ additional labour to remove and empty the drums and get them ready to put up again on the machine. Unless, therefore, a very large number of spare drums was available, as well as extra hands, the plant would not be running continuously, and in practice 2,300 yd. per day per machine must be considered a fair average working output.

Anyone situated near a large town may find another subsidiary use for a straw rope spinning machine. A lot of upholstery is done with Algerian and Coco fibre. When this fibre is wanted to be used over again, it has to be treated in order to restore its springiness or "curl," and it is therefore roped or twisted by the upholsterer before being carded. This roping is usually performed slowly and uneconomically by hand, but could be cheaply and quickly done by the straw rope spinner.

In conclusion, it may be said that straw rope is an article of extensive and extending use in many different forms of industry. At present the demand is met very largely by imports, but as conditions of trade improve, it should be possible to establish its manufacture in this country on a sound remunerative basis. The demand is a large and steady one, and a great advantage from the point of view of both maker and dealer lies in the fact that straw rope can seldom be used twice.

II. STRAW ENVELOPES FOR BOTTLES.—The trade in these articles has fallen off somewhat in late years. but is still considerable. The following figures for quantity and value of imports are given by the Board of Trade:—

Imports			*Value*		
1913	1920	1921	1913	1920	1921
Gross	Gross	Gross	£	£	£
1,047,302 ...	667,085 ...	471,635 ...	96,888 ...	159,630 ...	103,593

The majority of straw envelopes now come from Holland and France and are very largely used in the export trade. For internal transport they have been for some years rather superseded by sectional returnable packing cases, with corrugated straw board as an extra protection to bottles with specially valuable contents. The main advantage of these cases is that less space is occupied, but they are rather more expensive and less efficient in preventing breakage than straw envelopes, hence the use of the latter in the export trade as a rule. The straw envelope has lately been regaining its old position in home transport as well.

The principal users in this country are the cider makers in Somerset, Devon and Wilts, the whisky trade, bottling firms and exporters at various seaports, and the chemical and confectionery trades.

The machinery used for producing envelopes is easy to work and makes them very rapidly. The output of the different sizes varies from 200 up to about 500 envelopes per hour with power drive. The smaller sizes can also be worked by treadle if desired, but the output is of course less. There is no doubt, however, that these sewing machines are rather more complex and delicate pieces of mechanism than the general run of agricultural machinery and while they are in fact very easy to work and intended to be operated by unskilled labour or by girls, a skilled mechanic would be required to look after them at intervals. For this reason they are probably more suited for a factory than a farm.

Process.—The following is a general description of the method of making straw envelopes; details and the sequence of operations may vary somewhat with different types of machinery. The straw, when it has been "hackled" or combed out to lie evenly, is placed in a trough alongside the sewing machine. At this stage, if it is much longer than is required, it is cut to a length about 1 or 2 inches more than twice the length the finished envelope will be, by means of a guillotine knife at one end of the trough, the proper length being obtained by a wooden stop plate which can be fixed at any required distance from the knife. Under factory conditions or for large output, the "hackling" and cutting to length would be distinct operations; the material would then be brought to the seaming machine operation ready for use. The straws composing the envelopes are doubled over upon themselves before being sewn together (*i.e.*, for a quart bottle envelope which is about 15 in. long when finished, the straw would have to be 30 in. long plus an allowance of ½ in. to 1 in. for trimming after "heading" and "tying").

There is no particular objection to the ears being left on, provided that the tied end of the envelope is long enough for them to be clear of any row of stitching. In practice the ears are often found left in, but in the best quality envelopes made of rye straw which grows long, they are generally absent. Great accuracy in length in this first stage is not necessary, provided always that the straw is more than double the length of the finished article. All the sewing takes place at a fixed distance from the fold of the straw, which forms the open bottom end of the envelope.

It is essential that the straw should be thoroughly dry; damp straw will rot the thread, and is liable to split, and will produce damaged envelopes, when they are pressed into bales for transport.

The operator now takes a handful of straw and lays it in position on the operating table of the sewing machine; it is here that skill and experience are chiefly required to put on just the right amount required to make a good envelope, which should be firm, of the proper weight, and even in texture all round with no open or thin and loose patches. The necessary skill is soon acquired by practice, and the speed at which a good worker can feed the machine is very high. The working table of the machines is known as "the book"; it is hinged at the centre and the straw is placed upon it when lying open, and spread evenly out; the "book" is then shut with a metal finger piece, something like a book marker slipped in at the centre. The straw is thus doubled over evenly on itself. The thin finger piece can then be pulled out, and the folded straws are sewn together.

At one time the envelopes were sewn merely as a flat straw sheet which was then bent round to a circular shape and tied by hand, but practically all modern machines, such as those referred to in this article, produce the envelopes in the finished circular form required. The envelopes are given 2 or 3 rows of stitching according to the size or the machine used; it is usually the ordinary chain stitch which can be easily cut without unravelling. It is only a very large envelope that requires 3 rows.

Straw Envelope Sewing Machines.—The machines, of which particulars and prices are given below, are of German or Dutch manufacture, and so far as it has been possible to ascertain there is no English make obtainable.

Trade Mark.	*H P.*	*Type.*	*Capacity.*	*Approx. Price.*	*Power.*
			per hr.		
1. "Ne Plus Ultra"	½	2 stitch .	200–250	£50 £55	Power Foot treadle
2. "Negra" ...	¼	3 stitch ..	200–280	£53 £59	Power Treadle
3. "Nopel"	¾	3 stitch...	250–300	£58 £64	Power Treadle
4. "Rapid" ...	1·0	2 or 3 stitch.	400–500	--	Power only

No. 4 is a large machine and fully automatic. In this type, the position of the circumferential stitching is capable of adjustment or alteration to suit different bottle shapes. The envelopes produced range from 2 in. to about 4¾ in. diameter (Fig. 1).

After seaming, the envelopes are "headed" by an appliance operated by hand or treadle. The operation consists of squeezing tight the loose (*i.e.*, unsewn) end of the envelope, binding it and clipping off any surplus straw. Squeezing and trimming and binding are performed in the one appliance. Fig. 2 shows a hand-operated "header"; the pallet is adjustable to accommodate different lengths of envelopes, which are held in the crutch of the machine, while being bound. The treadle-operated grip is, however, the more convenient as both hands are then left free for binding.

The hand-operated machine costs about £8 10s. 0d. and the treadle machine £11, but there is nothing very special about them and they could probably be made locally for less

The finished envelopes are very light and bulky, and require baling for transport purposes, and a hand or power-press would be required for doing this—the hand-press costing from £25 to £40 according to capacity, the power-operated press rather more.

Envelopes are generally imported in bales of 2 gross. The size of a compressed bale of quart bottle envelopes is approximately 30 x 24 x 15 in. and the weight of such a bale should be 44 lb.[*] The weights of envelopes vary of course very much according to size and are from about 8 lb. per gross in the very small special sizes to 35 lb. or more in the large envelopes required by the confectionery trade, say, for large sweet bottles.

The quart bottle size in most common demand runs about 22 lb. per gross.

Prices of Imported Envelopes.—Quart size is the standard article and special sizes either above or below this are generally rather higher in price; the very small sizes are considerably more expensive. Present prices (April, 1923) for quart size are as follows:—

	s.	d.		s.	d.	
Dutch manufacture	3	0	to	3	8	per gross.
French „	3	8	to	4	0	„ „

These prices are higher than they have been at any time previously, owing to the existing straw shortage in Holland, Belgium and France. But for this shortage, the price would be about 2s. 6d. to 3s. per gross only. Pre-war prices were from 1s. 10½d. to 2s. It is of interest to mention that the managing director of one of the largest London importing firms has recently stated that he would be very glad to deal with home-manufactured straw envelopes, if they could be obtained in good quality and quantity, and at a reasonable price.

The machines described in these notes may be obtained through Messrs. Country Industries, Ltd., to whom any inquiries as to prices and delivery should be addressed, while the Secretary of the Rural Industries Intelligence Bureau will be pleased to give any additional information which may be in his possession.

* * * * * *

TRAINING IN COMMERCIAL POULTRY KEEPING.

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THERE are several reasons why it seems desirable to publish an account of the poultry department which is now very nearly completed at the Hertfordshire Institute of Agriculture, at Oaklands, near St. Albans. These may be summarised as follows:—

(*a*) The whole department has been laid out on a definite plan with the result that both unity and completeness have been secured.

In considering the details a small committee of poultry experts, under the chairmanship of Mr. T. W. Toovey, has rigorously excluded any unnecessary elaboration, and adhered to the principles of economy and utility. The plant is, therefore, perhaps the simplest and most economical that is likely to be commercially-successful.

Clearly the cheapest method of keeping poultry on farms would be the organized extension of the free run system, but the possibility of depredations by foxes should be borne in mind when choosing the site.

(*b*) The houses which have been erected are of a type which has been proved to give good results, and the design is so simple that they are both cheap and easily constructed.

(*c*) The main system of rearing is one that involves the fewest complications, while at the same time provision has been made for systematic natural hatching on a small scale.

(*d*) The completed department consists of an 800-bird plant with all the necessary rearing facilities to maintain it, and at the same time to supply sittings of eggs, etc. This size has been determined upon as it provides a complete one-man commercial proposition.

(*e*) The objects of providing this department are defined in the prospectus of the Institute as follows:—

(1) To demonstrate a system or systems of poultry keeping which actual accounts will show to be profitable, and which could be copied in the county with similar results.

(2) To provide the means of training young men and women in all details and processes in successful and profitable poultry keeping.

The information given should also appeal to the general farmer whether he thinks of keeping 100 or 1,000 birds. In these days farmers cannot afford to neglect any side line which might prove a source of profit. Poultry keeping on farms is too often neglected. This is most unfortunate as the farmer has often at hand the very conditions which would ensure a profit from well-managed poultry.

The Department was started in the spring of 1922. A month or two previously a score of pure-bred White Leghorn pullets and a "Daily Mail" laying house had been purchased at a sale, but apart from these two items the whole plant has been built up from nothing. Immediately after the poultryman had taken up his duties in March, 1922, steps were taken to commence hatching and to provide the necessary rearing houses. Eggs were purchased of reliable strains of Rhode Island Reds and White Wyandottes, and resulted in 300 pullets being reared. These came into profit from October onwards.

During the winter of 1922-3 further houses were completed in anticipation of hatching in the spring of 1923 enough birds to complete the stocking of the plant. To get the necessary eggs for hatching, a number of 2nd year breeding hens were purchased and mated with home-bred cockerels. These, along with the Leghorn pen and some cross-breeding pens, provided the required eggs for incubation or natural hatching. By the autumn of 1923 the plant will be complete.

Incubation.—An excellent incubator room was provided at very little expense in a disused stable, a portion of which was boarded off and the floor concreted. Electric light was introduced for convenience at night, and for testing eggs for fertility. On many farms there exist buildings which could be similarly cheaply converted. The rest of this building with part of the granary overhead is utilised as a food store.

Four incubators—two 100-size Hearsons, one 150-size Glevum, and one 150-size Gloucester were obtained.

Natural Hatching.—A natural hatching house has been provided to accommodate 16 sitting hens. The system is a copy of that so successfully practised by Mr. T. W. Toovey, of King's Langley. The total length of both the nest and the airing chamber is 3 ft. 3 in., 15 in. being taken by the nest

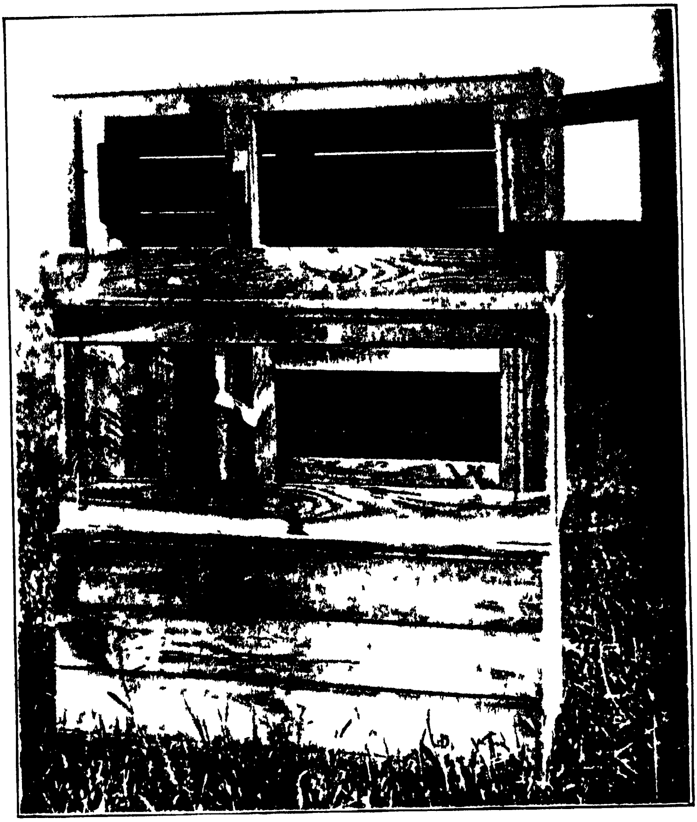

FIG. 1.—Nests for Natural Hatching.

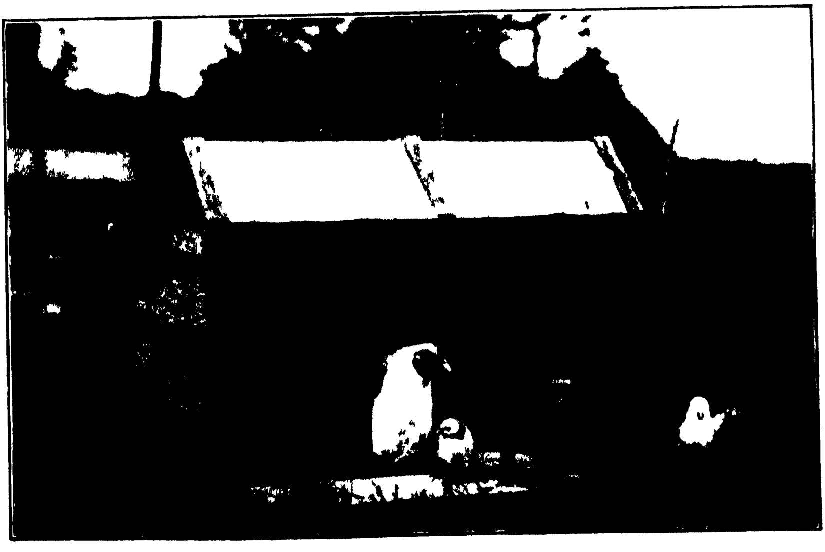

FIG. 2.—Coops used in Natural Hatching.

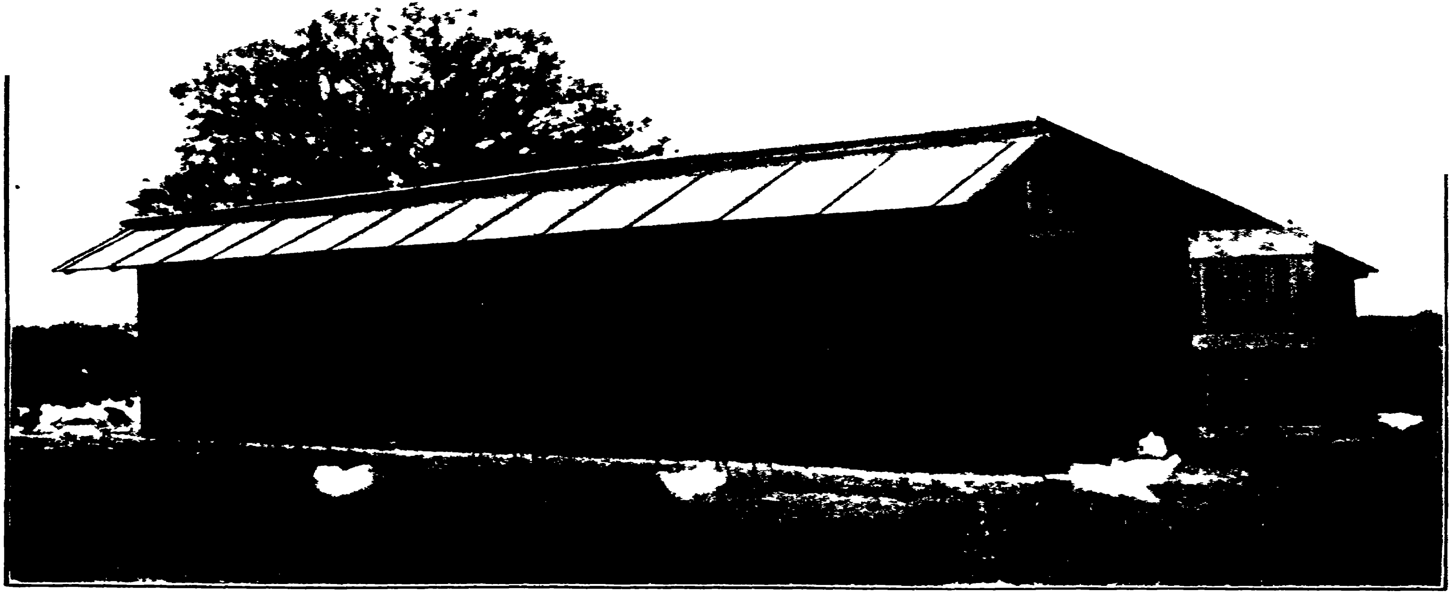

FIG 3 —Laying House.

and 2 ft. for the airing and feeding chamber. The depth is 17 in., and height 16 in. There are two doors in front and a small door between the nest and the airing chamber.

These nests can be arranged in any suitable building in tiers 3 or 4 deep. Quite a number of hens can, therefore, be set at one time, and require the minimum of supervision. On hatching, the hens with their broods are transferred to special coops which are set out in a series of small grass enclosures 10 ft. square. The use of these nests and coops (Figs. 1 and 2) enables natural hatching to be carried out on a small or a large scale, in a simple yet systematic manner.

Rearing.—Incubator chicks at 24 hours old are transferred to hovers which are placed in cabins 6 ft. square x 6 ft. high built for the purpose. There are now eight of these cabins, and these along with the "Daily Mail" house provide accommodation for 10 hovers. The hovers are designed for 100 chicks, but it is better not to exceed 70-80 in each. Each cabin is well ventilated and is situated on 500 square yards of grass run. The particular type of hover used is that made by Halsall. They are very simple in construction, and have given good results.

Chicks either from hens or from the hovers are transferred at 6 weeks old to the rearing houses, which are built to the same specification as the laying houses described below. Till the young birds learn to perch they are divided up into small units of about 30 by means of temporary and movable partitions of wire netting.

The following is a specification of one of the cabin houses:—

			£	s.	d.
240 ft. ...	6 in. F.E. boards at 14/- per square		0	16	10
100 ,, ...	5 in. × ¾ in. match boarding at 23/6 per square		0	10	0
84 ,, ...	6 in. × ¾ in. rough boards	at 20/- per square	0	8	5
182 ,, ...	2 in. × 2 in. ,, ,,	at 1⅛d. per foot ...	0	17	0
60 ,, ...	2 in. × 1 in. ,, ,,	at ¾d. ,, ,, ...	0	3	9
72 ,, ...	6 in. × 1 in. ,, ,,	at 1½d. ,, ,, ...	0	9	0
1 in. wire netting,	3 ft. × 3 ft.		0	12	0
5 yd. felt...	... ...				
1 pane glass,	36 in. × 13 in.				
Tar, garnets, etc.	... ...				
Labour ...	... .		1	3	0
			£5	0	0

Laying Houses.—The essential features of these houses are as follows:—They are 30 ft. long x 14 ft. wide, 8 ft. high in front and 5 ft. at back. No glass or dropping boards are used. and the top half of the front is open but protected by an overhanging hood (*see* Fig. 3). The floor is concreted and the sides and half the front are built of feather-edge boards. For the back, plain ½-in. boards are used, and these are covered on the outside by felt to prevent all possibility of draughts on the perched birds. The roof is boarded and covered with felt, though the cost may be lowered by dispensing with the boarding, using felt only. On completion the whole exterior was well treated with a mixture of tar, pitch and lime.

Dropping boards are dispensed with as these entail much labour, and their absence enables the perches to be placed only 18 in. from the floor, and therefore well away from any draught from the eaves. The perches are 3 ft. long and are placed at right angles to the back, over a manure pit. Each house provides accommodation for 100 laying birds, and each of these units is allowed half an acre grass run.

The specification for these houses is as follows:—

	3 in. × 3 in.		3 in. × 2 in.		5 in. × 2 in.	
	No.	Total length.	No.	Total length.		
Front uprights...	4 of 9 ft.	36 ft.	9 of 9 ft.	81 ft.		
Back „ ...	4 „ 6 ft.	24 ft.	9 „ 6 ft.	54 ft.		
Sides and middle uprights ...			10 „ 9 ft.	90 ft.		
Top rafters ...			11 „ 15 ft. 6 in.	170 ft. 6 in.	2 of 16 ft.	32 ft.
					1 „ 8 ft.	8 ft.
Plates... ...			6 „ 10 ft. 6 in.	63 ft.		
Over door, etc....			1 „ 12 ft.	12 ft.		
		60 ft.		470 ft. 6 in.		40 ft.

					£	s	d.
Summary	3 in. by 3 in.	Uprights and Rafters	60 ft.	at 2½d. per foot	0	12	6
	3 in. by 2 in.		470 ft. 6 in.	at 1⅜d. „ „	2	13	10
	5 in. by 2 in.		40 ft.	at 2⅜d. „ „	0	7	11
2 Doors		90 ft.	1 in. matching	at 26s. 6d. per sq.	0	11	11
Brackets...		78 ft.	2 in. by 2 in.	at 1⅛d. per foot	0	7	4
Door stops		75 ft.	2 in. by 1 in.	at 1d. „ „	0	6	3
½-in. boards		6½ sq.	5 in. by ½ in.	at 15s. per sq.	4	17	6
F.E.B.		4½ sq.	6 in. by ¾ in. by ¼ in.	at 14s. „ „	3	3	0
2 bundles laths ...			1 in. by ¼ in.	at 3s. 6d. each	0	7	0
Perches :							
1 piece		6 ft.	4 in. by 2 in.	at 2d. per foot	0	1	0
4 pieces		15 ft.	3 in. by 1½ in.	at 1¾d. per foot	0	8	9
24 pieces		3 ft.	2 in. by 1¼ in.	at 1d. „ „	0	6	0
3½ rolls felt		84 yd.	24 yd. rolls	at £1 per roll	3	10	0

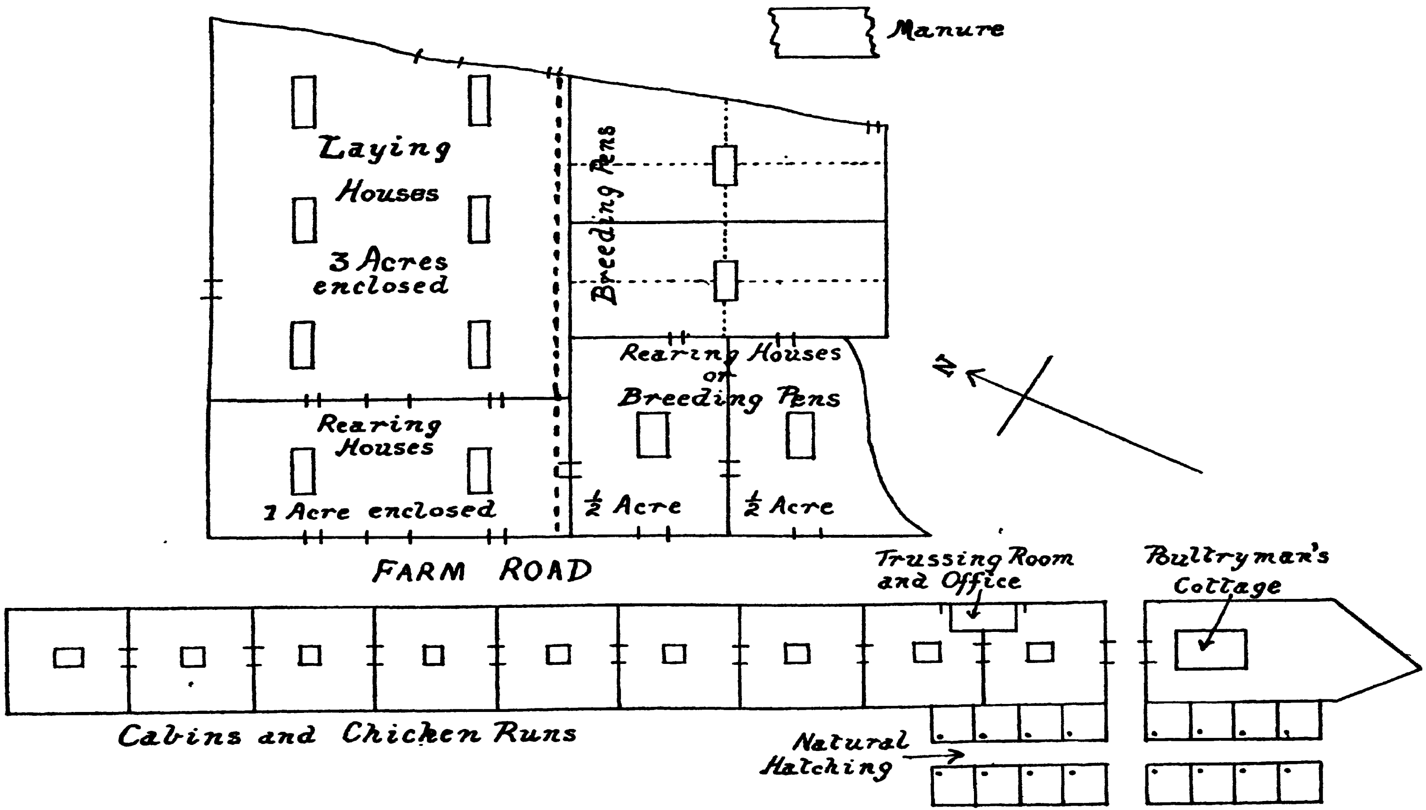

FIG. 4.—Plan showing Lay-out of Poultry Department, Herts Institute of Agriculture.

			£	s.	d.
5 bags cement		at 4s. per cwt.	2	0	0
30 ft. wire netting 1 in. mesh			0	12	6
6 gallons tar and pitch, locks, garnets, latches			1	2	0
Front to manure pit 60 ft.	8 in. by 1¼ in.	at 2½d. per foot	0	12	6
			£22	0	0
Labour: Two men for a fortnight			10	0	0
			£32	0	0

In this specification no charge has been made for gravel, which may be obtained locally. By using 2 in. x 2 in. for uprights instead of 3 in. x 2 in. and dispensing with boards under the roof felt the cost could be reduced to £27.

The Complete Plant.—The complete plant consists of twelve houses of the type just described under laying houses. Six of these serve as the laying houses proper and are enclosed in one open run which allows half an acre to each house. Two or three houses are used for breeding pens. Each of these is divided into two with a breeding pen in each, and each pen has a double grass run. The other three or four houses are used for rearing. In addition a small three-compartment hut has been erected to provide the poultryman with an office, a trussing room, and a chick food store. A plan showing the lay-out of all the houses is shown in Fig. 4.

It is not intended to keep more pure breeds than the three already mentioned, viz.—Rhode Island Reds, White Wyandottes, and White Leghorns. A number of first crosses will, however, be reared, as apparently, as so often happens with farm animals, the first cross in poultry, if effected in a desirable manner, provides stronger and more profitable birds.

Everything possible has been done to economise in labour. The removal of manure will be done at regular intervals by a horse and cart. Water has been laid on through the department as is shown by the dotted line in the plan.

A plant of this description is perhaps unique. There is nothing superfluous, and it is confidently anticipated that at a later date it will be possible to publish a balance sheet which will prove the soundness of its conception.

The actual cost of building up the poultry plant might be given, but the figures would not apply generally, as in this instance a good deal of home-grown timber was used. The following figures, however, given an approximate estimate when all the materials are purchased:—

		£	s.	d.
12 houses	... at £32	384	0	0
10 cabins	... at £5	50	0	0
Wire netting		80	0	0
Office, trussing room, chick food and egg store		25	0	0
Incubator room (old building utilised)		10	0	0
Four incubators		46	0	0
Coops, etc.		18	0	0
Laying on water		12	0	0
Incubator eggs and breeding birds		120	0	0
Sundries		25	0	0
Labour		180	0	0
		£950	0	0

On this basis the cost of setting up an 800-bird poultry plant approximates to 24s per bird when live stock are included, and 20s. per bird exclusive of live stock.

* * * * * *

THE PRINCIPLES OF POULTRY FEEDING.

I.

POULTRY can produce concentrated, palatable and easily digested human food, in the form of eggs and meat, from materials that are frequently unsuitable for other domestic animals and might otherwise be wasted. Waste and surplus vegetable material from the garden and allotment, household scraps, the residue of grain left from the harvest fields and stack-yards, are instances of food materials which the hen is capable of converting into eggs and meat. When given free range, particularly over arable land during cultivation, poultry consume large quantities of grubs and worms, insects and green food, and are known to be valuable agents for the destruction of ground pests. Hence, under suitable conditions and at certain seasons not only will poultry find much of their own food, but will help to keep down destructive insects.

The object of the poultry-keeper is to convert various feeding materials into eggs and meat in the most profitable manner, and therefore some knowledge of the several aspects of the science and practice of feeding is desirable. The functions of food are:—

(1) To maintain the body of the fowl in normal healthy condition.

(2) To provide for production, *i.e.*, growth, flesh and eggs.

In order to maintain the body of a healthy adult fowl in normal condition, *i.e.*, without gain or loss of weight, food is required to keep up the heat of the body, to provide energy for digestion and the movements of the various active organs of the body such as the heart, lungs, intestines, etc., and to repair the waste of body tissue which is constantly going on even in the body of a resting and unproductive animal. If only sufficient food for maintenance is given to the fowl, few eggs and no additional flesh can be produced. For production, additional food must be supplied, and if rapid and constant production is required, the supply of food must be not only liberal but of a suitable character and be supplied under suitable conditions.

The value to the poultry-keeper of any feeding stuff depends mainly on the following factors:—

(1) Composition.
(2) Digestibility.
(3) Mechanical condition.
(4) Value in comparison with other feeding stuffs.
(5) Class of stock to be fed and the object in view

Composition of Feeding Stuffs.—Every feeding stuff consists of various chemical constituents, but as several of these constituents possess similar nutritive values, they are for practical purposes classified into groups. The principal of these groups are:—

(1) Proteids.*
(2) Carbo-hydrates, *i.e.*, starch, sugar, fibre, &c.
(3) Oils and fats.
(4) Mineral matter.
(5) Water.

Proteids.—The proteids are a vitally important food constituent. They are essential for the maintenance of the fowl and for all forms of production. Whilst under certain conditions proteids can fulfil the functions of the carbo-hydrates and fats, the two latter can never fulfil the functions of proteids. The nutrition of the animal, however, is achieved much more efficiently and economically when all three constituents are supplied in proper proportion. Proteids should never be supplied in excess. Not only are foods rich in proteid the most expensive to purchase, but if unnecessary quantities of proteid are fed to poultry, considerable and unnecessary strain is thrown upon the kidneys and liver in excreting the surplus.

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* A group of food constituents known as the amides is for the purpose of this article included in the proteid group, to which they are closely allied. They are chiefly found in rank young grass and roots and their functions are not at present thoroughly understood.

Carbo-hydrates, Oils and Fats.—These supply the fowl with heat and energy and any surplus consumed beyond what is necessary for this purpose is stored up in the body as fat. Fibre, which is one of the carbo-hydrates, constitutes the outer coat of seeds and is found in the stems and leaves of plants. As the plant ripens this fibre often becomes of a tough woody character and so far as our present knowledge goes, fowls can digest this fibre only to a very small extent; in fact, apart from the necessity of supplying a certain amount of bulk in a poultry ration, it is advisable to eliminate fibre from the poultry ration as far as possible. Oils and fats have a similar function to carbo-hydrates in the body of the fowl and supply heat and energy, but are nearly two and a-half times as efficient in this respect as carbo-hydrates. An excess of fats in the foods should be avoided, however, as otherwise the digestion of the fowl will be affected. On the other hand, the yolk of the egg contains over 33 per cent. of material of a fatty nature and consequently the laying hen must have sufficient fat producing material in her rations.

Mineral Matter.—Poultry, especially laying hens, undoubtedly require considerable quantities of mineral salts, particularly those of calcium, such as carbonate of lime. It is probable that growing birds and laying hens are in practice inadequately supplied at times with mineral salts. Growing birds require regular supplies to enable them to grow and to build up their frames. Laying hens, especially those of heavy laying strains, use up considerable quantities of mineral salts in producing their eggs and unless they obtain sufficient supplies in their food, the body tissues are drawn upon and the healthy equilibrium of the body is disturbed. It is probable that fowls can absorb mineral salts in an inorganic form, such as for instance, calcium phosphate, magnesium sulphate, etc., but the poultry-keeper will be well advised to include in the poultry rations those feeding stuffs, such as freshly-cut green bone, fish meal, meat meal, skimmed milk, etc., and fresh green stuffs, which are rich in mineral salts. The use of such feeding stuffs in proper proportions will not only ensure a sufficient supply of mineral salts, but also of the much discussed accessory food factors, the vitamins. Cod liver oil is rich in the vitamin known as Fat Soluble A, and is often used in the poultry ration for this reason at the rate of a teaspoonful to every pound of the food. It is particularly useful for growing chicks and for hens producing eggs for hatching purposes.

Water.—All foods, even the driest feeding stuff, contain more or less water, while turnips may contain as much as 92 per cent. From the chemical point of view this water has no more food value than ordinary water which is taken in the usual way. A succulent food such as fresh clover, however, is probably of more value to the hen than dried clover meal.

Use of Tables.—The table to follow at the end of this article shows the chemical composition of most of the feeding stuffs used by poultry-keepers. This table will enable the poultry-keeper to determine whether a feeding stuff is rich or deficient in one or more of the essential food constituents. For example, maize is seen to be fairly rich in fat and carbo-hydrates, but somewhat deficient in proteid; oats are a better balanced feeding stuff than maize, whilst meat meal, fish meal, dried yeast and maize gluten meal are seen to contain high percentages of proteid. Dried yeast is also rich in mineral salts. An unusually high percentage of ash or mineral salts shown on analysis of a *manufactured* feeding stuff, however, often indicates the presence of dirt or sand.

Digestibility of Food Stuffs.—There is little use in giving feeding stuffs which the birds cannot easily digest. Such efforts are demanded from the digestive organs of the modern layer, which is expected to produce upwards of 200 eggs in the year, that if the food given to her places too great a tax on her digestive energies, or if the nutriment contained in the food is insufficient, a high egg yield is impossible. The foods used should be palatable and easily digested in addition to being nutritious. Unfortunately very little reliable knowledge based on scientific investigation is yet available regarding the digestive powers of poultry. Such knowledge as is available, however, indicates that the capacity of poultry for digesting the various feeding stuffs in common use approximates more closely to that of the pig than of other farm animals. Apparently poultry can obtain little nutriment from crude fibre such as the husk of oats, or the fibrous portions of cut clover prepared from plants past the flowering stage. Maize and maize meal appear to be more digestible than either wheat or oats, and there is considerable evidence to indicate that maize is a most valuable grain for poultry when combined with foods rich in proteids and some bulky material such as cut clover of good quality. The fat in oats is apparently easily digested by fowls, and this is confirmed by the old-established practice of using Sussex ground oats for fattening purposes. In spite of the indigestible character of oat husk, Sussex ground oats are found in practice to be one of the most valuable foods for general use. The scanty scientific information available on this subject emphasises the need for further reliable scientific investigation into the digestive capabilities of poultry. The commercial importance of the science of poultry-feeding is obvious. It is just as important as a knowledge of the heat-producing values of various fuels is to the engineer and to the owners of steam engines. In the meantime, the poultry-keeper should be guided in his feeding methods by the best modern practice, bearing in mind any advantages offered by locally produced feeding stuffs, seasonal supplies and variations in market prices, and should keep an alert eye open for any new information which may result from further scientific investigation.

The table given in Part II shows not only the chemical constituents of the various feeding stuffs, but also the percentage of digestible nutrients. The latter percentages are based on direct experiments with quadrupeds, including pigs, and although further scientific investigation may show that these percentages are not quite accurate for poultry, they probably constitute in the meantime the best guide available. Thus it is seen in the case of oats that whilst this grain contains 10.3 per cent. of proteid, 8 per cent. only is digestible, but nearly the whole of the fat is digestible and 44.8 per cent. out of 58.2 per cent. of soluble carbo-hydrates. In considering the composition of a feeding stuff, the digestible nutrients are a better guide to the feeding value than the mere chemical analysis, though attention should be paid to the amount of fibre and ash present.

The Class of Stock to be Fed and the Object in View.—The natural common sense of the average poultry-keeper will no doubt indicate to him that young chickens require feeding stuffs and methods of feeding different from those suitable for adult laying stock or fattening stock. For example, ducklings intended for consumption when about 10 weeks old may be supplied with some forcing and fattening foods from birth; on the other hand, young pullets required later on to endure the strain of heavy egg production must be fed with the object of building up frame and constitution. Breeding stock too must not be fattened, but maintained in hard, healthy and fairly productive condition. Laying stock during the autumn and winter months will require careful and liberal feeding on egg-producing foods. These various objectives will necessitate different rations and methods of feeding if commercial success is to be fully achieved.

Mechanical Condition of Feeding Stuffs.—The fineness or coarseness of meals, the amount of extraneous matter such as dirt, stones, weed seeds, etc., in samples of grain, the presence of " smutted " grains, obvious adulteration with husks or other worthless material, the colour, smell and taste of a sample may all be regarded as part of the mechanical condition of a feeding stuff and should be carefully observed by the purchaser. Sour or mouldy meals and samples of light husky grain should invariably be rejected.

(*To be concluded.*)

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GROWING TURNIP, SWEDE AND MANGOLD SEED IN THE HOLLAND DIVISION OF LINCOLNSHIRE AND ADJOINING DISTRICTS.

THOMAS W. LANE.

CONSIDERABLE acreages of root seeds are grown in Lincolnshire, more especially turnip and swede, in a less degree mangold seed; cabbage and kale seed to a limited extent, and occasionally rape seed. In addition a large acreage of brown and white mustard is grown chiefly for manufacturing purposes, but some white mustard is also grown for seed purposes. The fact that south Lincolnshire is specially adapted for seed growing may be due to several causes, chief of which are the natural richness and deepness of the alluvial soil, proximity to the sea, and the large acreage of rich pasture land broken up during the past few years. As this land cannot be used for corn for several years the choice of crops is almost limited to brown mustard, turnip and swede seed and potatoes. Some farmers object to brown mustard from the fact that it is often extremely difficult to get rid of, and appears as a weed for many years. Turnip and swede seed are not open to the same objection to the same extent.

The writer has no exact information as to the acreage under root seeds. It fluctuates considerably; for instance, in the event of a somewhat general failure, as in 1922, the next season's acreage is above the average, but in normal times it runs to several thousand acres. A large proportion of the produce is exported. The actual volume of the world's trade in seeds has probably grown during the past few years but competition from Continental growers has increased perhaps in greater ratio, therefore an expansion of the industry is not likely.

It is difficult to estimate cost of production or probable returns. The best and cleanest land is usually chosen, the cost of cutting and thrashing is higher than with corn crops, and planting adds considerably to the expense. The crop is a speculative one, but in a series of years the average returns are perhaps substantially higher than with corn crops.

Probably in relation to other crops there is a higher proportion of swede and turnip seed grown in the Holland division of Lincolnshire than in any other district in the country, and perhaps the largest acreage. The root seed growing area extends beyond the borders on a diminishing scale, but in the outskirts of the seed growing area and on isolated crops it has sometimes been found that larks and wood pigeons destroy or damage crops in the early stages, and linnets take a considerable toll of any surviving crop when in seed. One of the reasons why farmers in this district like to grow some turnip seed is that it provides a change of rotation and is harvested early, between getting the clover hay crop and mustard cutting and corn harvest. The stubble can be ploughed up early and is available for wheat if required. One of the drawbacks of the crop is that in the event of its being a thin or poor plant weeds are very troublesome, the land is left rather foul, and the straw is of little value.

The bulk of the crops is grown for the trade on contract from seed stock provided by the merchant. Stock seed being the produce of selected roots and the seed trade being highly specialised it will be understood that merchants select specially for the requirements of their own particular trade. The industry has created a large body of expert planters and cutters, who are usually paid by piece work—planting by the thousand or by the acre, and cutting by the acre—and earn good wages.

The soil of the district varies from light silt almost to clay, with a small area of black land and skirt land (silt and black mixed). The most generally reliable land for turnip seed is medium or good bodied silt land.

Turnip and swede seed can only be grown successfully even in this district on the best and cleanest land. It must be in good heart and these crops grown only at long intervals. There is nearly always a considerable percentage of crop failures, in some seasons a small percentage only surviving. A thoroughly prepared seed bed is the first essential for success; errors of cultivation account for some failures—amongst other causes are insufficient preparation of land, especially insufficient rolling, drilling seed too deeply, drilling artificial manure with seed, and drilling too late—but even under apparently perfect management failures occur.

Turnip Seed.—It was at one time thought that turnip seed could only be grown satisfactorily on fallows, but it is now taken after almost any crop excepting perhaps white corn. Well mucked fallows, however, remain the best preparation.

The seed is drilled on the flat at the rate of 2 to 3 lb. per acre, usually with four coulters in a drill, and as farmers' drills vary in width the rows vary from about 18 to 23 inches apart. It is usually drilled on rolled work but sometimes after a light harrowing. The seeding period extends from the second week in August to the first week in October, according to the class of land and individual farmers' ideas. The tendency of recent years has been towards late drilling as it has been found that the late drilled crops yield better—perhaps partly because if bulbs are developed they are more tender than plants, and partly because a crop of roots makes more demand on land than small plants and leaves the land lacking in sufficient stamina to finish the seed crop. It may be suggested that on medium soils, in order as far as possible to ensure plants getting strong enough before the winter, yellow turnip should be drilled not later than the 14th September and white turnip by the 21st, but farmers do not usually differentiate sufficiently between the varieties. On freshly broken land later sowing may be desirable and on strong or stiff and black land earlier sowing is indicated, but from the fact that we have not had much winter in recent years, farmers have acquired a habit of late sowing.

In addition to perhaps some fertiliser applied in the autumn it is not unusual to top dress in the spring with up to 2 cwt. of sulphate of ammonia or nitrate of soda.

The crop may require considerable attention in the early stages. In the first place, to keep flea and other pests from damaging or destroying it, as soon as the plant appears it is probably rolled, perhaps horse hoed once or twice, and harrowed between rows in the autumn. It is again hoed and perhaps harrowed in the early spring to destroy small weeds and to free the plants from chickweed Provided, however, that the crop is free from weeds, very late autumn or very early spring cultivation is not desirable as the crop resents disturbance during frost. As the season advances it is also cultivated more deeply between the rows from time to time as long as horses can be kept in the crop, and in some cases as a final operation the rows are hilled or moulded up with the object of burying the remaining weeds, chickweed especially, and with a view to holding the plants up and preventing storm damage. This, however, is not a general practice.

In case of gaps in the crops, planting is resorted to for filling in, plants being taken from thicker parts. A very thick plant is sometimes horse-hoed across, but unless it is thick all over the land, hand-hoeing is better. Some farmers do not thin out at all. It cannot be stated definitely that thinning out is best in all circumstances and conditions, but it may be assumed to be advantageous generally, resulting as a rule in stronger plants. The ideal plant perhaps is one that has come regularly and thinly throughout, as these plants are not drawn up, and develop into broad-leaved strong plants, giving a satisfactory yield.

Swede Seed.—One advantage of swede seed growing over turnip is that, as it is not planted till November, there is plenty of suitable land available (it is generally taken after potatoes), only a small space being wanted for the plant bed in proportion to the acreage to be planted. The price paid is also higher in consideration of the cost of extra labour involved in planting. Swede seed is a more speculative crop than turnip—the rewards may be greater but so are the risks. Planting subjects it to a severe check and unless conditions are favourable often a considerable number of plants die off. Being slower in growth in all stages it appears more liable to attack by pests.

The usual method in Lincolnshire for swede in contradistinction to turnip seed is to sow the seed on a plant bed any time from about 20th July to 14th August, the general experience being that it should at any rate be sown by the first week in August. It is sometimes broadcast, but usually drilled with a hand drill about 12 inches from row to row, or with a corn drill, the advantage of drilling being convenience in hoeing. Stocky plants are desirable, and if land can be spared it is well to allow one acre plant bed for about 7 acres crop, less of course being wanted for broadcast sowing. At this time of year it is very difficult to obtain a plant if the weather is exceptionally dry, and there may be considerable difficulty in warding off the turnip flea; the mustard bug also is frequently active and troublesome.

The usual allowance of stock seed is 2 lb. per acre, which in favourable circumstances would provide plants far in excess of requirements, but contingencies have to be considered.

Planting is done from early November to February, as circumstances permit, but owing to the large acreage in potatoes in this district, farmers are frequently much occupied in lifting these until late, and only a small proportion of swede is planted in November. The advantages of early planting are considerable: the plants recover from the check and become established before winter and in consequence get a quicker and better start in the spring. Given sufficient moisture in the land for the plants to strike root they would probably be better planted in October. If left too long on the bed they are apt to be drawn up, and if there is much chickweed, etc., may be weakened or choked out of existence.

Swedes are planted in rows from about 24 to 28 inches apart with about 6 to 12 inches from plant to plant, according to individual predilection. In this district planting is done with a tool resembling a shortened miniature spade, but a few planters use a dib. It is a good but not sufficiently followed practice to shorten roots before planting so that there are no long ends to double up. It may be argued in support of close planting that there is always a prospect of a proportion dying off. In favourable conditions the wider planting may be found to give the best average results, but there appears to be no golden rule in the matter as either on occasion yields heavily or the reverse.

Planting takes place either on land harrowed down and marked, out or in the furrow seams, according to the character or condition of the soil. Plants are occasionally ploughed in but this practice is not to be recommended. Rolling is often done after planting and again in the spring, especially if the land is found light. It is a fairly general practice to cut back swedes, especially if they are weak, to encourage spread of plant.

Swede seed is occasionally drilled to stand. In this case it is usually drilled later than for plants, perhaps late in August. The land has to be particularly clean for a drilled crop as it occupies the land for nearly twelve months: it is therefore mostly drilled on fallows and on fairly heavy land which is not much subject to annual weeds. On the average perhaps planting gives better results, although on occasions a drilled crop may come into bloom earlier and get away from the ravages of the turnip flower beetle. There is,, however, a prejudice in the trade in favour of planted swedes. Hilling or moulding up is practised more with swedes than with turnips. Some fertiliser may be applied in the autumn, and in addition swedes require and are nearly always given in the spring a generous top dressing of sulphate of ammonia or nitrate of soda.

General Notes on Turnip and Swede Seed Crops.—The following observations apply generally to both the turnip and swede seed crops. It is desirable to grow different varieties well apart as there is a risk of natural cross fertilisation (especially with some varieties), producing undesired results. When in bloom the crops are rogued, *i.e.*, the false plants, which are distinguished from the true plant by a difference in colour of the flower, are removed. This is done by, or under the direction of men of experience, employed by the merchants contracting, or by their agents.

Seed should be thoroughly fit before cutting; it is sometimes diminished in yield and value by premature cutting, but the greatest danger is in premature stacking which may result in making seed useless for growing purposes.

Seed cutting commences in forward seasons with early varieties of turnip towards the end of June and with swede perhaps the end of July. It is cut by hand and tied with string and left usually for over a week in the field. The sheaves are laid lightly on the stubble and turned after weathering for a day or two, and in the event of rain are again turned or lifted. Showery weather after cutting does not damage the seed to any extent if it is turned or lifted. The custom is to lay the sheaves with heads to the north-east, most of the strong winds being expected from the south-west. In loading and carting, the crop has to be carefully handled to avoid waste of seed. It is usually put in small stacks to prevent heating and cloths are placed on the steddles to preserve seed which spills out freely when handling. Seed is occasionally thrashed " out of the field," in which case it has to remain longer in the field than when stacked. If stacked, turnip seed must stay in the stack fully six weeks, longer is desirable, and swede takes more time to condition.

The seed has to be very carefully thrashed (especially swede seed) to avoid damage, but machine owners in this district are experienced in the matter and on the whole do exercise care. One difficulty, however, is for farmers to obtain machines when wanted, and delivery of seed is often delayed. The average yield of turnip and swede seed is roughly about 24 bushels an acre, but on the best or new lands sometimes considerably more. Those, however, who attempt to grow either crop on moderate land are doomed to disappointment.

Mangold Seed.—Although this district is possibly better adapted for the production of swede and turnip seed than any other it cannot be claimed that it is so well suited in all respects for mangold seed and this is not grown to the same extent.

The trade place a proportion of their requirements here as a provision in case of failure of crops in other districts. It is seldom that crops fail altogether in this district, but better samples may be produced on drier soils and in other districts in some seasons.

As contrasted with swede and turnip seed new or extra rich land is not to be desired for mangold seed, which frequently fails to ripen early enough but persists in growing on. The land requires to be clean as mangold seed is a late crop. Stiff or heavy land usually produces the best seed and it holds crops up better. The crop is generally hilled up as it has not much root hold. As mangold seed is liable to natural cross fertilisation, varieties, and crops of different colour especially, should be grown well apart.

The usual method is to sow seeds in a plant bed about the first week in August and plant out in the autumn or spring. It is perhaps more common to plant in spring because it is thought that the plants on the beds are better protected from frost. If planted in the autumn there may be considerable losses, while if losses occur it is better to have them in the bed than in the field. On the other hand the autumn planted may come to hand slightly earlier, which is an advantage. The plants are usually set in rows about 27 inches apart and about 8 to 12 inches from plant to plant, sometimes wider. It is now an increasing practice to top plants when beginning to run—usually to pinch or take a small piece off the lead with the object of minimising risk of storm damage through the plants getting too tall, and to encourage the spread of laterals. Sometimes the crop is left till later, when the top is cut off with a hook, but this results in the crop being put back, which is not desirable.

The crop is cut by hand, tied in small sheaves, and put into small stooks, and it has to remain in the field for some time before it is fit to be stacked. It is usually put up in small and very narrow stacks and in this district, at least, stacks should always be ventilated. This is neglected at times and in consequence the stacks may heat and seed be rendered useless. Seed is not as a rule ready for threshing before Christmas.

Insect and Other Pests.—One cause of the failure of the turnip seed crop in the early stages, especially if the weather is hot and dry, is the turnip flea, and occasionally mustard bugs will clear off crops and are difficult to combat. Slugs are destructive, especially after peas and clover. Larks are destructive in severe weather (in the absence of other green food particularly) as also occasionally are wood pigeons. Chickweed is often very troublesome to deal with, and if the weather does not permit of frequent cleaning it may smother the plant in its early stages or in the spring.

The turnip flower beetle has also done material damage to turnips and swedes when in bloom, in 1922 especially; hitherto it has not been found to do much damage to turnip seed, although swede has been damaged materially. The usual course of this pest is to start on the earlier varieties of turnip and follow on in succession as crops come into bloom, and then on to swede seed and brown mustard. Some efforts have been made to deal with this pest, usually with poisonous or nauseous washes or powders, but with no marked success. By the time the mischief is evident the crops are so far advanced that it is often impossible for a horse machine to get through them and difficult even for a man with a knapsack sprayer. The crops may recover to some extent but they come to hand later. An early season seems to be favourable to swede. For instance, in 1921, swede crops generally were good, as they got away from their enemies.

For several years past turnip gall weevil attack on swedes has been very marked, but the plants affected have not apparently failed more than clean plants. However, rooks may pull up the plants to get at the grub. One great trouble with swede is what is known locally as "Canker," which does not usually show itself till plants are running to seed and then they begin to break down, and in bad cases nearly all may go, so as to render the crop worthless. A stem maggot is also troublesome at times, although crops much infested have on occasion yielded well (in quick growing seasons).

The various pests affecting root seed crops call for serious investigation, especially perhaps the turnip flower beetle.

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BLOSSOM WILT OF PLUM TREES.

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The object of the present note is to call the attention of fruit growers to unsuspected sources of infection for the Brown Rot diseases of fruit trees, particularly with reference to outbreaks of Blossom Wilt of plum trees, caused by *Sclerotinia* (*Monilia*) *cinerea* forma *pruni*.* In certain seasons the Blossom Wilt con-

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* For a general account of the Brown Rot diseases caused by this fungus see the Ministry's Leaflet No. 367.

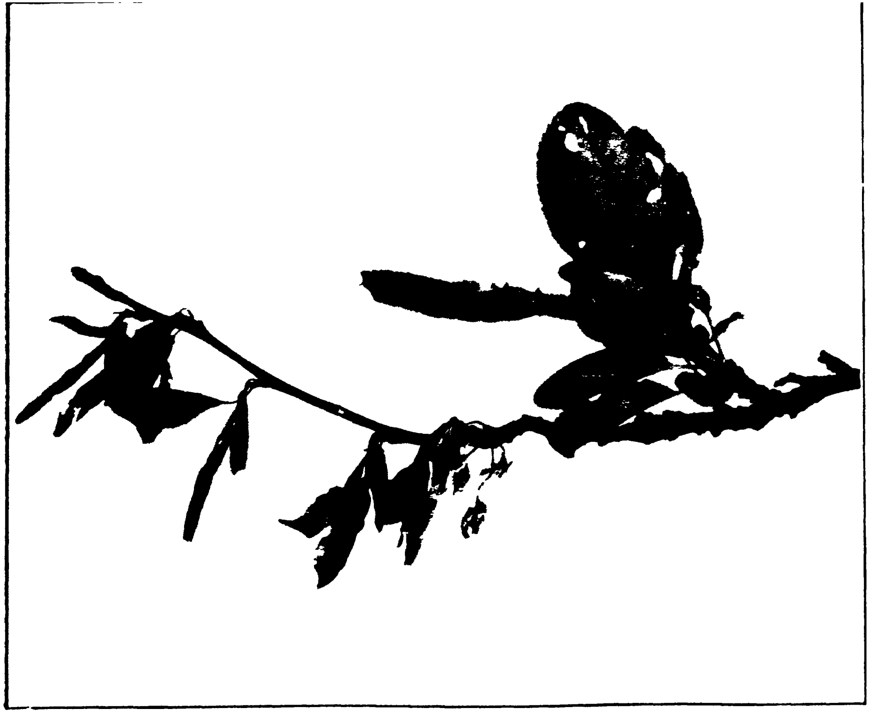

Fig. 1.—Young Branch of Plum Tree Killed-back by Infection through the Flowers

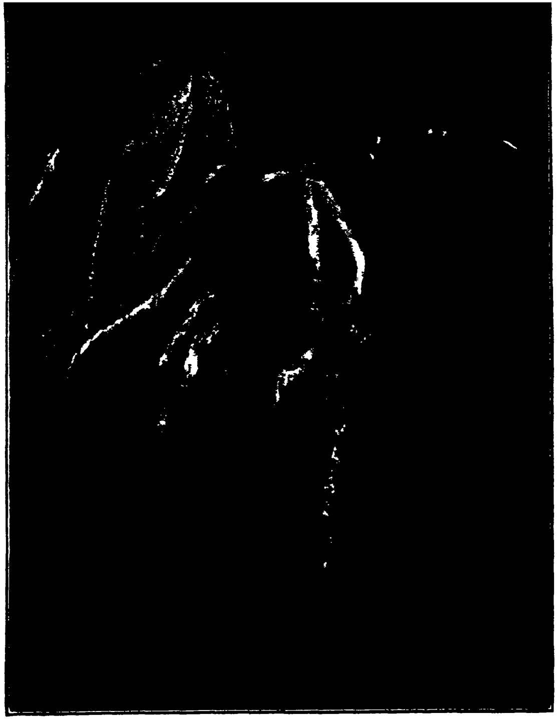

Fig. 2.—The Flowers (seen in Fig. 1) through which Infection occurred: the Fructifications of the Fungus are present on the Flower-stalks.

dition assumes serious proportions, for not only are the flowers themselves destroyed but the fungus extends from the flowering spurs into the branches, which are killed back. When many of the young branches of a tree are killed in this way, a condition not infrequent on some varieties of plums, the brown withered flowers and leaves give the tree a noticeably " blighted " appearance.

The chief sources of infection for the primary outbreaks of the brown rot diseases on plum and cherry trees are the mummied fruits which are allowed to stay on the trees through the winter. Serious outbreaks of blossom wilt, however, may occur when there are no " mummies " in the immediate neighbourhood. In the case of the blossom wilt disease of apple trees,* caused by another specialised form of *Sclerotinia cinerea*, it has been shown that the sources of infection are the spore pustules which develop on the spurs killed the previous year and on the cankers. So also in the blossom wilt of plum trees serious outbreaks sometimes occur in the absence of mummified fruits and can be traced to cankers, dead twigs and spurs.

A case in point came under the writer's notice early in May this year. In a plantation of plum trees of three varieties, viz., Giant Prune, Czar, and Purple Egg, the Giant Prunes all showed a number of young branches killed back from the tip for a distance varying from about six inches to over a foot (Fig 1), while the other two varieties were almost free from such damage. A close examination of the infected branches showed that at the lower end of every dead portion there was a flowering spur on which the flowers (through which the infection had occurred) were brown and withered, and usually bore grey tufts consisting of chains of spores produced by the fungus (Fig. 2). No mummied plums were to be found at all in the plantation, for care had been taken to remove from the trees, during the winter, all obvious sources of infection, and the nearest trees bearing " mummies " were too far away to account for the extent of the outbreak. A careful search on the trees, however, showed that here and there old dead twigs were present which had been killed by the brown rot fungus in the previous season, and had been overlooked when the rest of the dead wood had been cut out; these had produced spore pustules during the winter, and the numerous spores to which they gave rise served to infect the flowers as they opened It was observed that the blossom wilt was most intense in the immediate vicinity of such dead twigs.

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* See this *Journal*, Vol. XXIV, No. 5, August, 1917, pp. 504-513, and Leaflet No. 312.

Now it is to be noted that the blossom wilt fungus of plum trees not only infects the flowers but also the young leaves and the fruit. When the leaves become infected the young shoots are killed, giving rise to the "Wither Tip"* condition when the leading shoots are killed, and to what has been termed "Shoot Wilt"† when the short lateral shoots become infected, in which case cankers usually arise on the branches. These cankers and dead shoots in their turn serve as further sources of infection. The fruit may become infected not only when ripening but also when in the green growing state.

It is obvious, therefore, that, if at all practicable, the dead branches resulting from an attack of blossom wilt should be removed *as soon as possible*,‡ and for two reasons: (1) The dead flowers serve as sources of infection for the leaves and fruit; (2) if the dead parts are removed early when the contrast between the dead and the living parts is striking, there is less likelihood of portions being overlooked as will almost certainly occur if the operation is left over until the winter.

After a severe infestation of brown rot the precaution should be taken of examining the trees again during the following winter and removing all mummied fruit and dead twigs and branches. It is sometimes almost impossible, however, to remove all sources of infection owing to the fact that fruit spurs and young lateral shoots are sometimes killed without the disease extending into the branches, and such small spots of infection, since they do not produce any conspicuous die-back, evade detection, especially in winter. An extra precaution to minimise the possibility of infection from such sources is to spray with the winter wash recommended for the brown rot diseases,§ viz., one containing 1 per cent. of soft soap and 1 per cent. of caustic soda, to be applied as late as possible but before there is any risk of injury to the opening buds.

Growers of cherries are reminded that the fungus which is responsible for these brown rot diseases of plum trees also causes blossom wilt and fruit rot of sweet cherries, and where plum trees are interplanted between rows of valuable standard cherry trees they may prove a menace to the latter unless careful attention is given to keep them free from the brown rot fungus.

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* Wormald, H. A. "Wither Tip" of Plum Trees. *Ann. Appl. Biol.*, Vol. V, No. 1, July, 1918, pp. 28-59.

† A Shoot Wilt and Canker of Plum Trees caused by *Sclerotinia cinerea*. *Annals of Botany*, Vol. XXXVI, No. 143, July, 1922, pp. 305-320.

‡ In the plantation referred to, the grower, realising the circumstances of the case, promptly set men to work cutting out the dead wood and all was removed during the second week in May.

§ See Leaflet No. 367.

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WART DISEASE OF POTATOES ORDER OF 1923.

THE Ministry has given serious consideration to the question of what further steps can be taken to arrest the spread of Wart Disease in England and Wales, and on the strong recommendation of its Potato Advisory Committee, supported by the Agricultural Advisory Committee, has issued the above Order, the chief object of which is to secure that growers shall be able to obtain seed potatoes free from infection.

The Order* revokes the previously existing Orders on the subject, and all growers of potatoes and all potato merchants and seedsmen are asked to make themselves familiar with the new requirements, the chief of which are summarised below.

(1) **Procedure in Cases of Outbreak of the Disease.**—The appearance of the disease on any land in England and Wales must at once be reported to the Ministry even though the presence of disease on that land has been reported in a previous year. Directions as to the measures to be taken by the occupier of the premises will be given by an Inspector.

Potatoes visibly affected with Wart Disease must not be sold or offered for sale for any purpose.

(2) **Restrictions on Planting Potatoes in Infected Land.**—In land on which Wart Disease has been known to exist at any time, the only potatoes which may be planted are those stocks of approved immune varieties which have been inspected while growing and officially certified as being true to type. (See also paragraph 4 as to general restrictions on planting.) A grower may, however, plant potatoes of approved immune varieties which have been saved by him from his previous year's crop on the same land.

A list of approved immune varieties may be obtained on application from the Ministry.

(3) **Infected Areas.**—The Order declares as an "Infected Area" the whole of Wales, the counties of Monmouth, Chester and Stafford, the whole of the county of Lancaster south of the River Ribble, together with Preston and Fulwood, North Salop, Birmingham and Sutton Coldfield, and certain parishes

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* Copies and any further information may be obtained from the Ministry.

in the counties of Worcester and Derby. Several parishes which were certified under previous Orders, still remain Infected Areas. In addition, the provisions of previous Orders as to Infected Areas were applied to many groups of allotments and to a large number of premises; and these also are all Infected Areas under the present Order.

No potatoes grown in an Infected Area may be moved or consigned to any place in England and Wales which is not in an Infected Area. An exception to this rule is, however, made in the case of ware potatoes of approved immune varieties provided that a statement is made on the invoice or sale note relating to the consignment or in a label or ticket inserted in or attached to the package containing the potatoes, to the effect that the potatoes are of an approved immune variety, that they were grown in an Infected Area, and that they are not intended for planting. Any person receiving potatoes consigned from an Infected Area without this statement must notify the Ministry of the fact within seven days, and must not part with or plant the potatoes without the permission of the Ministry.

(4) **Restrictions on Planting Potatoes and on the Sale of Potatoes for Planting.**—The Order requires that all potatoes planted or sold for planting must have been officially certified either as having been grown on land free from Wart Disease, or as having been inspected and found to be free from the disease, or as being of an approved immune variety true to type. As regards seed grown in England and Wales, the certificates will be issued by the Ministry. The necessary inspections may be made by an Inspector of the Ministry or by some competent person previously approved by the Ministry. For Scotch seed the certificates will be issued by the Board of Agriculture for Scotland, and for Irish seed by the respective Ministries of Agriculture in Ireland.

When potatoes are sold for planting the seller must furnish the buyer with the number of the certificate relating to the potatoes sold. In order to assist both buyers and sellers of potatoes, it has been arranged that the certificate numbers shall have prefixes as follows:—

C.L. (= clean land) for potatoes grown in clean districts or from crops which have been inspected and no disease found.

T.S. (= true stocks) for approved immune varieties which have been inspected and found to be true to type.

The letter A will be used in addition for potatoes grown in an Infected Area, and the certificate numbers for such potatoes will thus have the prefixes A.C.L. or A.T.S.

The following simple but important directions should be carefully remembered when purchasing seed potatoes, whether of English, Scotch or Irish origin, in future:—

(*a*) When buying potatoes for planting in infected soil.	The certificate No. must be T.S.........; or A.T.S.
(*b*) When buying potatoes for planting in clean soil in an infected area.	C.L......; A.C.L......; T.S......; or A.T.S......
(*c*) When buying potatoes for planting in land which is not in an Infected Area and on which the disease has never appeared.*	C.L......; or T.S......

Certificates, however, will not be required by a grower who wishes to plant seed saved from the crop grown in the previous year on the same premises.

Potatoes grown outside Great Britain and Ireland must not be planted or be sold for planting in England and Wales except under a licence from the Ministry.

(5) **Arrangements for Issue of Certificates.**—Growers who intend to sell seed potatoes must make early application to the Ministry for the necessary certificates. Growers of immune varieties should apply for inspection of their crops whilst growing in order that they may obtain the certificate necessary to enable the potatoes to be planted in infected soil. If the crop is not inspected only a "C.L." or "A.C.L." certificate can be issued. It will be necessary in districts in and near Infected Areas for crops of susceptible varieties also to be inspected before a "C.L." or "A.C.L." certificate can be issued.

The Ministry will be prepared to arrange for the necessary inspections; the fee for inspection will be 2s. 6d. per acre or part of an acre. No charge will be made for the issue of certificates where no inspection by the Ministry's officers is entailed.

(6) **Restrictions on the Sale of Scotch and Irish "Ware" Potatoes.**—Purchasers of Scotch ware potatoes must obtain, either from the grower of the potatoes or the person in Scotland from whom they are purchasing, a statement, either that the potatoes were not grown in an Infected Area in Scotland, or that the potatoes are of an approved immune variety, or that the crop has been officially inspected and that Wart Disease was not found to exist thereon. This requirement does not apply to potatoes from Scotland sold within an Infected Area in England and Wales.

In the case of Irish ware potatoes the statement must be either that the potatoes are of an approved immune variety or that they were grown on land believed by the relative Ministry of Agriculture to be free from Wart Disease. This requirement also does not apply to potatoes from Ireland sold within an Infected Area in England and Wales.

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* **Potatoes with certificates bearing a number prefixed by A.C.L. or A.T.S. must on no account be planted in such land.**

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MONTHLY NOTES ON FEEDING STUFFS.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Animal Nutrition Institute, Cambridge University.

Soft, Oily Bacon—Its Cause and Prevention.—In the June issue of the *Journal*, an interesting hypothesis has been developed as to the cause and prevention of soft, oily bacon. In that article the theory is developed that the main causes of oily bacon are (1) excessive oil in the diet, and (2) the chemical nature of the oil itself. The theory has been put forward after an investigation of cases which have occurred in bacon factories of pigs which, on curing for bacon, were found to produce soft, oily sides. It is therefore important to realise that the deductions made by the writer of the article and the figures indicating the " softening power " of various foods are only tentative and still require to be proved before being accepted by the general farming community as sound. The article is, however, of value in indicating the need for further research in this subject, and as showing that, however skilful a bacon curer may be, his knowledge is useless unless the feeder provides the right raw material for him to work upon.

In consequence of the views expressed in the article referred to, it may perhaps be advisable at this stage to summarise such facts as are already known with regard to the production of body fat.

(1) The chemical composition of the natural body fat of animals varies with the species and the environment. The body fat of most species of animals consists chiefly of varying admixtures of palmitin. stearin and olein, the first two fats being solid at ordinary temperature, while olein is liquid.

(2) Fats can be built up by the animal body from all three foodstuffs, *i.e.*, proteins, fats and carbo-hydrates. As far as the writer is aware there is no preferential storage of body fat from fats originating from any of these three main classes of foodstuffs.

DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv	Price per lb. Starch Equiv.
	s	lb.	Cwt. s.	Ton. £ s.	£ s.	£ s.		s	d.
Wheat, British	--	—	11/3	11 5	0 18	10 7	71·6	2/11	1·56
Barley, British Feeding	—	—	9/3	9 5	0 14	8 11	71	2/5	1·29
" Danubian "	30/-	400	8/5	8 8	0 14	7 14	71	2/2	1·16
" Persian "	27/3	"	7/8	7 13	0 14	6 19	71	1/11	1·03
Oats, English White	—	-	11/6	11 10	0 16	10 14	59·5	3/7	1·92
" , Black & Grey	—	—	11/-	11 0	0 16	10 4	59·5	3/5	1·83
" Scotch White	—	—	12/8	12 13	0 16	11 17	59·5	4/-	2·14
" Canadian No. 2 Western	29/9	320	10/5	10 8	0 16	9 12	59·5	3/3	1·74
" No. 3 "	28/9	"	10/1	10 2	0 16	9 6	59·5	3/2	1·70
" Feed	26/6	"	9/3	9 5	0 16	8 9	59·5	2/10	1·52
" American	25/-	"	8/9	8 15	0 16	7 19	59·5	2/8	1·43
" Argentine	24/-	"	8/5	8 8	0 16	7 12	59·5	2/7	1·38
Maize, American	39/-	480	9/1	9 2	0 15	8 7	81	2/1	1·12
" Argentine	39/-	"	9/3	9 5	0 15	8 10	81	2/1	1·12
Beans, English Winter	—	—	10/6	10 10	1 17	8 13	67	2/7	1·38
" Rangoon	—	—	8/3	8 5	1 17	6 8	67	1/11	1·03
Millers' offals—									
Bran, British	—	—	—	6 0	1 10	4 10	45	2/0	1·07
" Broad	—	—	—	7 15	1 10	6 5	45	2/9	1·47
Fine middlings (Imported)	—	—	—	8 10	1 5	7 5	72	2/-	1·07
Coarse middlings (British)	—	—	—	7 15	1 5	6 10	64	2/-	1·07
Pollards (Imported)	—	—	—	6 7	1 10	4 17	60	1/7	0·8
Barley Meal	—	—	—	9 12	0 14	8 18	71	2/5	1·34
Maize "	—	—	—	10 5	0 15	9 10	81	2/4	1·25
" Germ Meal	—	—	—	8 7	1 2	7 5	85·3	1/8	0·89
" Gluten-feed	—	—	—	8 15	1 12	7 3	75·6	1/11	1·03
Locust Bean Meal	—	—	—	8 0	0 11	7 9	71·4	2/1	1·12
Bean Meal	—	—	—	12 7	1 17	10 10	67	3/2	1·70
Fish "	—	—	—	16 15	4 18	11 17	53	4/6	2·41
Linseed	—	—	—	20 7	1 16	18 11	119	3/1	1·65
" Cake, English (9°/. oil)	—	—	—	10 5	2 4	8 1	74	2/2	1·16
Cottonseed Cake, English (Egyptian Seed) (5¼°/. oil)	—	—	—	7 5	2 0	5 5	43	2/6	1·34
" " Egyptian (5½°/. oil)	-	—	—	7 0	2 0	5 0	42	2/5	1·29
Coconut Cake (6°/. oil	—	—	—	8 7	1 15	6 12	73	1/10	0·98
Palm Kernel Cake (6 °/. oil)	—	—	—	5 15*	1 7	4 8	73	1/2	0·62
" " Meal (2°/. ")	—	—	—	4 17	1 8	3 9	71·3	1/-	0·54
Feeding Treacle	—	—	—	4 15	0 9	4 6	51	1/8	0·89
Brewers' grains, dried, ale	—	—	—	6 2	1 7	4 15	49	1/11	1·03
" " " porter	-	—	—	5 15	1 7	4 8	49	1/10	0·98
" " wet, ale	—	—	—	0 19	0 11	0 8	15	0/6	0·26
" " wet, porter	—	—	—	0 15	0 11	0 4	15	0/3	0·13
Malt Culms	—	—	—	8 0*	1 19	6 1	43·4	2/10	1·52

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of May and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 6d.; P_2O_5, 4s. 3d.; K_2O, 2s. 10d.

(3) The composition of the body fat can be altered by the nature of the food given, and evidence exists which demonstrates the possibility of the storage in the body of food fat which is otherwise foreign to the organism. This fact has been demonstrated both in the case of the dog and the pig. Lean dogs fed with linseed oil developed fat which differed considerably from the normal body fat, this fat remaining liquid even at 32° F. On the other hand, lean dogs fed on mutton suet produced body fat which remained solid at 112° F. The addition of linseed oil to the diet of selected pigs also led to deposition of soft, oily fat, giving the characteristic smell of linseed oil, and containing substances peculiar to that oil.

There are two trials which the writer would like to see undertaken with pigs intended for bacon production. The first would be a comparison of linseed cake meal and oil extracted linseed cake meal, or maize meal and oil extracted maize meal. The result of such a trial would indicate the extent to which the production of soft fat is dependent upon the nature and amount of the oil present in the food, as apart from the character of the food itself. The second would be a comparison of three feeding stuffs selected from the table given in the article under discussion, one with a high softening power number, one with a medium number, and one with a low softening power number.

FARM VALUES.

CROPS.	Value per Ton on Farm. £ s.	Manurial Value per Ton. £ s.	Food Value per Ton. £ s.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.E. d.
Wheat - - - - -	8 7	0 18	7 9	71·6	2 1	1·12
Oats - - - - -	7 0	0 16	6 4	59·5	2 1	1·12
Barley - - - - -	8 2	0 14	7 8	71·0	2 1	1·12
Potatoes - - - -	2 1	0 4	1 17	18·0	2 1	1·12
Swedes - - - -	0 18	0 3	0 15	7·0	2 1	1·12
Mangolds - - - -	0 16	0 3	0 13	6·0	2 1	1·12
Good Meadow Hay - -	3 16	0 16	3 0	31·0	1 11	1·03
Good Oat Straw - - -	2 1	0 8	1 13	17·0	1 11	1·03
Good Clover Hay - -	4 5	1 4	3 1	32·0	1 11	1·03
Vetch and Oat Silage - -	1 16	0 8	1 8	14·0	2 0	1·07

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending June 13th.*				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.15	13.15	13.10	13. 0	16. 9
„ „ Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
„ „ „ neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.)	...	..	...	2. 2	3. 4
„ (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.)	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11. 5	4. 8
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
„ „ (T.P. 30 per cent.)	...	...	...	3. 0§	2. 0
„ „ (T.P. 26 per cent.)	...	2.10§	...	...	...
„ „ (T.P. 24 per cent.)	...	2. 6§	2. 7§	...	...
„ „ (T.P. 20-22 per cent)	...	2. 3§	..	2. 7§	2. 4
„ „ (T.P. 18 per cent.)	...	...	2. 0§	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	3.15	2. 2
„ (S.P. 30 per cent.) ...	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7.10†	7. 0	6.12	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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Foot-and-Mouth Disease.—The existence of foot-and-mouth disease was confirmed on 20th June on premises at Skeffling, near Patrington, Hull, in the East Riding of Yorkshire. The slaughter of the affected and in-contact animals was immediately undertaken, and the usual prohibition of movement restrictions were applied to the area within a radius of fifteen miles of the infected premises.

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The Ministry's Register of Dairy Cattle.

THE Sixth Volume of the Ministry's Register of Dairy Cattle can be obtained either direct from the Ministry or from H.M. Stationery Office. The price of the Volume is 2s. 6d.

Although the Ministry's Milk Recording Scheme is now becoming generally known throughout the country, and the practice of milk recording is being increasingly adopted, apparently few breeders are aware of the existence of the Ministry's Register of Dairy Cattle. It is published annually, and its main object is to assist farmers by bringing to their notice cows which have an authenticated record of proved milk-yielding ability. The Register contains a list of breeders and owners of cows whose yields have been certificated by the Ministry. The standard which a cow must reach before it is eligible for entry in the Register is 8,000 lb. of milk yielded in one milk-recording year, or an average of 6,500 lb. in two or more consecutive milk-recording years. Any cow, moreover, which has yielded not less than 24,000 lb. of milk over a period of three consecutive years, and which has calved at least three times during that period, may be awarded a certificate of merit on application by its owner, and a list of such certificated cows is given in the Register.

An interesting feature of the Sixth Volume is the addition of a Bull Section, which is intended to be of use to farmers who desire to obtain the services of bulls of proved milking strain. Bulls are eligible for this section whose dams and sire's dams have been entered in the Register, or which have two or more daughters so entered.

The current Volume of the Register contains particulars of 1,500 cows representing 14 breeds other than cross-bred cows which have qualified under the conditions outlined above. Of these cows 1,350 qualified for entry on the one-year standard alone. It may be mentioned that only certificated cows are entered in the Register, and that consequently the number of cows contained in the current Volume is only a small proportion of those which would be eligible on their milk yields if their owners had applied for certificates. The Ministry hopes, however, that as the existence of the Register becomes more widely known and its object more generally understood, farmers will avail themselves of the useful information which it contains.

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Silver Leaf Order, 1923.

FRUIT growers are doubtless aware that in order to check the more rapid spread of silver leaf disease, which has done much damage throughout orchards in this country, the Ministry issued an Order in 1919 (Silver Leaf Order of 1919) making it obligatory on growers of plum trees to cut out and destroy all dead plum trees and all dead wood of plum trees before the 1st April in each year. Whilst much dead and infected wood has been destroyed during the last three years, the Ministry has, in virtue of the experience gained and the knowledge of more recent research, deemed it necessary to make some changes in the Order. The matter has been considered by the Ministry's Horticultural Advisory Council, and, on their advice, the Minister has now made a fresh Order known as The Silver Leaf Order of 1923, which came into effect on the 1st June, 1923.

This new Order requires that in future the work of destruction of dead trees and dead wood must be done in the case of apple trees as well as plum trees, and, the date laid down for completion of this work is the 15th July in each year instead of the 1st April.

In addition to these requirements, and apart from the Order, the Ministry strongly recommends growers to cover with anti-fouling paint, white paint, or tar, all wounds of apple and plum trees, whether made by cutting or pruning, or in any other way. Such wounds are particularly susceptible to the entry of the fungus, *Stereum purpureum*, which is the cause of silver leaf, and if they are left exposed there is a great risk of infection.

A copy of the Ministry's leaflet dealing with silver leaf and any further information on this subject that is available may be obtained on application to the Ministry at 10, Whitehall Place, London, S.W.1.

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Horticultural Research at the Long Ashton Station in 1922.

THE Annual Report of the Horticultural Research Station at Long Ashton, Bristol, contains short accounts of the experimental work which has been carried out at the Station during the year 1922 into problems concerning fruit production. The experiments on the manuring of fruit trees are particularly opportune, for on this subject information is either scanty or entirely lacking. The Long Ashton workers have realised that the fruit tree has two functions to perform simultaneously, namely, to produce wood growth and to develop a fruit crop. The fruit grower, whilst naturally interested in securing vigorous growth in young trees, is more immediately interested in the production of a heavy crop, and has employed numerous methods of manuring to secure this end. Manuring in spring and in the autumn have been advised and criticised. Nitrogenous manures have been recommended by some and condemned by others; in short the manuring of fruit trees in the past has been a question of groping in the dark. The experimenters have given an account of the way in which trees act when starved of essential chemical elements, and fruit growers will realise the fundamental importance of ascertaining these facts before progress can be made with certainty. The results of these experiments should be read by all fruit growers, as they are very instructive as to the kind of manures that are required, and stimulative of thought as to the need for securing a proper balance of the different kinds.

It has been realised that in addition to manures other factors influence fruit bud formation, and the Report contains an account of the effect of "ringing" and "notching" in causing trees to produce fruit. For many years it has been known that fruit trees too productive of shoot growth could be induced to produce fruit by clamping the trunks with iron springs, and the Station has reported that the process of "ringing" causes a similar crop formation. In the present Report there is an account of an investigation as to the working of these processes.

Bush fruit has not been neglected, and the Report gives an account of work on the nomenclature of raspberries which has been conducted in co-operation with the Horticultural Research Station at East Malling, Kent. The Report shows the confusion existing with regard to raspberry varieties; and fruit growers will look forward with considerable interest to the further reports of this joint work.

The Station started as a National Fruit and Cider Institute, and whilst it has developed its activities in fruit in recent years, its interest and activities in connection with the making of cider have not declined, and there are several accounts dealing with cider. The growers of cider fruits in Worcestershire and Hereford will find it particularly interesting and instructive to read the surveys which have been made of the cider orchards in those two counties; whilst all growers of market varieties of fruits will be interested to see that the Station has studied the problem, which has been ever present with them, of dealing with the small and culled apples of market varieties for cider purposes. The Report gives an account of the qualities of cider made from Allington Pippin, James Grieve, Lord Derby, Bramley Seedling, and other market varieties, and contrasts the vintage qualities of these ciders with that made from the ordinary cider sorts. Best cider, the Report states, can be made by judicious blending of ciders from vintage varieties, adjusting deficiencies in quality, and exercising control of the fermentation, so that the resultant vintage has the right proportions of acid, sugar and tannin. Market varieties are deficient in tannin, and generally possess too much acid, so that to utilise surplus table fruit to profitable account by conversion into cider, it is necessary to blend with these a proper proportion of vintage kinds, selected to add the qualities which are lacking in ciders from market sorts and balancing where excesses occur. It is a practical problem with which the majority are concerned, and if a successful solution were discovered might lead to the withdrawal of the inferior samples of market fruit from the commercial markets, to the benefit of the whole fruit industry.

Accounts of experimental work on insect pests and diseases of fruit trees are given. There is a full account of the life history and control of the Apple Blossom Weevil, a pest which for many years has caused considerable damage to young fruit blossoms.* Not the least interesting or important is the work which is being done on the physiology of Leaf Scorch, a trouble which has come much to the fore in recent years in districts where fruit is being grown on light types of soil, such as exist in Norfolk and parts of the west. The problem, apparently, is not an easy one, but the Report shows that the matter is being investigated on somewhat broad lines. It is clear that the absence of potash, as was at one time believed by many, is not the primary cause of this scorch, but that sudden interruptions of the water supply are a more serious factor in inducing its appearance.

The Report of this work is written in a manner which will appeal to the average fruit grower, and should be widely read.

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* See this *Journal*, October, 1922, p. 637.

Green Food and Minerals for Pigs.

The following account of a pig feeder's experiences in Suffolk has been communicated to the Ministry by Mr. A. W. Oldershaw, B.Sc., County Agricultural Organiser for East Suffolk :—

Mr. R. Flatman, of Mellis, who has very successfully practised dry feeding of late, had a litter of pigs born on 1st September, 1922; they were bred at home, the sow being a Large Black, and the boar Large White. The young pigs had access to the dry feeder when quite small and still suckling, and went entirely on to it when taken from the sow. The following mixture was used :—65 per cent. barley meal, 25 per cent. middlings, and 10 per cent. fish meal.

The pigs were kept in an open stock yard, with deep sheds, and the yard was divided into sections by iron hurdles. There was thus a nice comfortable shed for the pigs to go into, whilst they could also go into the open air at will, but they had not access to any soil.

The pigs were on the sow for 8 weeks and did well until 12 weeks old, when the best pigs began to lose the use of their hind legs and became very dull. The hair also began to grow too much.

Mr. Flatman was aware of the research work on animal nutrition which is being conducted at the Rowett Institute at Aberdeen, and at Cambridge University, and he communicated an account of the trouble to these bodies.

As a result of advice given by them he began to give the animals green food, the green tops only of marrow-stem kale, as the pigs would not eat the stems. He also placed in reach of the pigs a mixture of chalk and sifted house cinders—the result of burning half wood and half coal. The treatment began about Christmas time.

The green stuff was eaten well, and the chalk and ashes mixture was also picked up from the trough from time to time. There was a gradual improvement in the symptoms until the pigs were better. They also ceased rooting amongst the manure, etc. In the later stages of fattening the fish meal in the mixture was reduced to 5 per cent., and 10 per cent. of gram substituted.

The first pig was killed on 31st January and weighed 9 stones dead weight; the second, killed about 10th February, weighed 10 st. 7 lb. The remaining nine, killed on 21st February, averaged 9 st. 9 lb. dead weight. In all six out of the eleven pigs were over ten stones at about twenty-five weeks old, which

was not bad considering the set back they had owing to their illness.

Incidentally it is interesting to note that Mr. Flatman finds that the dry system of feeding is very economical in labour. A boy, aged 15, looks after 96 pigs.

There appears to be little doubt that the recovery of the pigs was due to the feeding of green stuff, chalk and ashes, and the whole incident forms an interesting instance of the value to the farmer of recent work on animal nutrition, which has brought out the value of green stuff in supplying necessary vitamines and of an ample supply of mineral substances to rapidly growing animals such as pigs. It is true that in the experiments by Professor White and Mr. Roberts (this *Journal*, April, 1923) the value of green food was not found to be so great as is commonly supposed. Nevertheless, pigs quite commonly suffer from symptoms such as those given above. The cost of supplying the necessary green food is very small and it undoubtedly brings the feeding of the pigs nearer to a state of nature. The chalk and ashes also cost practically nothing, and the fact that the pigs relish them seems to indicate that the minerals supply a natural craving. Pigs grow very rapidly and undoubtedly require a large quantity of mineral matter for their bones, etc. The foods commonly fed to them do not often contain a very large proportion of mineral matter. In a state of nature pigs, by rooting amongst the earth, are probably able to obtain what they require. When shut up in buildings or stock yards they cannot do this, and hence it appears only common sense to supply them with any minerals they will eat.

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QUESTIONS IN PARLIAMENT.

Conciliation Committee Agreements.—In answer to a question asked by Mr. Noel Buxton in the House of Commons, on the 4th June, as to whether the Minister of Agriculture could state when the Bill dealing with the compulsory registration of conciliation committee agreements will be introduced, Sir Robert Sanders replied that he was not yet in a position to make an announcement on the subject.

Sheep Dipping Order.—Mr. Westwood asked the Minister of Agriculture in the House of Commons, on the 7th June, if he was aware that, for two years prior to the passing of the Double Dipping (Sheep) Order, 1920, there were 790 outbreaks of sheep scab in the United Kingdom; that, in the two years since the passing of the Order, there have been 1,440 outbreaks; and that the Order is a costly failure and is causing grave dissatisfaction and great loss to sheep farmers in the South of Scotland; and would he consider the revoking of an Order which has failed in the purpose for which it was enacted?

The *Minister of Agriculture* (*Sir Robert Sanders*) replied:—The reply to the first part of the question is in the affirmative. The increased number of outbreaks merely indicates that more cases of scab are being brought to light, and I cannot agree that the Order has failed in its purpose. As the Sheep Double Dipping Order, 1920, has not been applied to the South of Scotland, I presume the second part of the question must refer to the Regulations which local authorities make for their own protection. While insufficient care in cleansing flocks of scab still persists in certain districts in Wales and Scotland, I should not feel justified in asking these local authorities to withdraw their Regulations. I am aware of the feeling on this matter which exists in the South of Scotland, and I may say that the Ministry is about to issue a fresh Order dealing with sheep scab on lines which I hope will eventually lead to the stamping out of this disease.

Labelling of Dried Milk.—Mr. Lamb asked the Minister of Health in the House of Commons on 3rd May, whether his attention had been directed to an advertisement of Milkal, household milk, which is described as machine-skimmed milk from which only the water has been eliminated; and whether, in view of the implied suggestion that only the water has been eliminated and not the butter fat, he would say what action he proposed to take for the protection of the consumer who may not be aware of what is actually removed by the process of machine skimming?

Lord E. Percy (Parliamentary Secretary to the Ministry of Health) replied "Yes, Sir. My right hon. friend's attention has been drawn to the advertisement in question, and he agrees that it is likely to mislead readers as to the nature of the article advertised. He has no power to take action with regard to such advertisements, but he is considering Regulations to provide for the proper labelling of dried milks."

In reply to a further question on 13th June, Mr. Neville Chamberlain, Minister of Health, said that the Regulations were in draft.

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REPLIES TO CORRESPONDENTS.

Feeding of Dried Nettles.—L.P. asks for information as to feeding of nettles to stock.

Reply: Stock will not touch fresh nettles, but when dried they have, according to Emil Pott (*Handbuch der tierischen Ernaerhrung*, 1904, I, p. 102), a good effect on the yield of dairy cows and the coats of horses.

According to R. Gouin (*Les Aliments du Bétail*, 1922, p. 67) they should be cut before flowering and allowed to wilt for some little time on the ground, and then given in mixture with some dry fodder to minimise their laxative effects. He adds that they may be dried, but are then better fed, after being moistened with hot water, with the addition of salt.

Feeding Brussels Sprout Stems.—M.O. asks about feeding Brussels sprout stems to stock.

Reply : Brussels sprouts—the entire plant—have been successfully fed to sheep in times of vegetable glut. Stock will consume with relish the leafy parts of the plant but the coarser and more fibrous parts will be avoided, particularly late in the season.

Similarly, in the case of marrow-stem kale* it is usually found that stock do not much relish the stems after Christmas.

Eradicating Ground Elder.—A.Y. asks whether spraying would be of use.

Reply : The Ministry does not recommend spraying for the eradication of ground elder.

Constant hoeing of the ground and cutting off the leaves as soon as they appear, as recommended in Leaflet No. 194 for the eradication of coltsfoot, would probably get rid of the weed in the course of a year or two, but to be really useful it must be done frequently.

Sawdust Manure.—B.W. asks whether sawdust might be used to soak up liquid manure for application to the land.

Reply : Sawdust does not decompose in the soil as readily as straw, and when used on the land it has a tendency to promote the growth of fungi. Where sawdust is used for litter, the resulting manure should preferably be applied to grass land.

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Leaflets issued by the Ministry.—Since the date of the list given on page 283 of the June issue of the *Journal*, the following leaflets have been revised.

No. 242.—" Stripe " Disease of Tomatoes.
„ 262.—Tomato Leaf Rust or Mildew.
„ 355.—Growing Wild White Clover and Late-Flowering Red Clover for seed.

The following new leaflets have been issued.

No. 397.—White Clover.
„ 398.—Town Refuse as Manure.

The following leaflets have been re-written.

No. 151.—Cleanliness in the Dairy.
„ 300.—The Breeding of Utility Pigeons.

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* For feeding to Poultry, see this *Journal*, May, 1922, p. 177.

NOTICES OF BOOKS.

Heredity in Poultry.—(R. C. Punnett, F.R.S. London: Macmillan & Co., Ltd., 1923, 204 pp., 10/- net.) No one is better qualified to write with authority on heredity than Professor Punnett, and a book by him devoted entirely to heredity in poultry will be welcomed by all interested in the breeding of the fowl. It is to experiments with poultry that we owe much of our fundamental knowledge of Mendelian principles as applied to animals. In particular the illuminating interpretation of "dominance" and "recessiveness" in terms of "presence" and "absence"—first applied to explain the heredity of comb characters in poultry—was the result of experiments involving many thousands of birds carried out by Bateson and Punnett in the early years of the present century. It is safe to say that the genetic analysis of the fowl is more complete than that of any other animal. Nevertheless, the author is careful to point out that our knowledge, extensive as it is, is practically limited to *visible* characters (such as colour of plumage, nature of comb). For example, little is yet known regarding such an important invisible character as fecundity. It is true that Pearl in America advanced the theory that fecundity is mainly a "sex-linked" character—that high egg-laying capacity is passed from father to daughter and from mother to son, but not direct from mother to daughter. The author, however, is of opinion that this theory requires confirmation. Similarly, he questions whether there is any trustworthy evidence that size or shape of egg is transmitted through the male. The investigation of invisible and economic characters generally presents considerable difficulties to the scientist. It is interesting to learn that there is some prospect of such investigations becoming easier, for there is some reason to think that when invisible characters are sex-linked, as they often appear to be, they may be closely associated with visible sex-linked characters. If this should prove to be the case, early advances in knowledge may be hoped for. The book would be improved by tables showing the genetic analysis of each breed of fowl, that is to say, giving particulars of the characters in each breed regarding which precise knowledge is now available.

It may be added that Professor Punnett's work constitutes a valuable text-book on the Mendelian theory generally, and as such should prove of great value to students of Genetics.

Market Milk.—(Ernest Kelly and Clarence E. Clement. London: Chapman & Hall, Ltd., 1923, 445 pp., 19/- net.) This book is practical and interesting and should prove of use to a wide circle of readers. The opening chapter dealing with the consumption of milk and dairy products in the United States is of considerable interest, showing the estimated consumption per head of the population to be about 1 pint per day. It is also stated that the number of cows kept, in comparison with the population, has declined steadily from 287 cows per thousand people in 1840 to 218 in 1921.

Sections devoted to milk as a food for adults and infants are of considerable interest. The chapters dealing with bacteriology and the production of milk of a low bacterial count are well written and full of useful data. The latter should be carefully read by all interested in clean milk production, emphasising as it does the necessity of cleanliness in the cowshed, sterilization of utensils and prompt and efficient cooling, In connection with the organization of milk control, the inspection of dairy farms and town depots is dealt with at some length. The educational features of dairy inspection are of interest, stress being laid on the utility of clean milk competitions as a means of interesting both producer and retailer in clean milk production. Score cards as used by inspectors when inspecting dairy farms and city plants are given. Producers' Co-operative Milk Distributing Organisations receive consideration, the necessity of their establishment, the advantage to producers and methods of financing being fully discussed. Care is taken to point out the essentials without which the formation of Co-operative Societies cannot be undertaken with success.

Chapters on city milk plants, with plans, and on pasteurisation will be of interest to those handling city milk supplies.

As the authors state, no treatment of market milk problems is complete without a discussion of milk prices and the cost of distribution under various headings. Table 95 shows that according to Hibbard and Erdman costs of distribution, *i.e.*, transportation, handling of plant, and delivery, amounted to 49 per cent. of the total cost of production in 1917 in Chicago and other cities. It is evident that the authors have made an exhaustive study of this question, and the student will obtain useful and interesting information from a careful study of these chapters.

The milk trade in all its aspects is dealt with in this book, but we lay it down with a feeling that the authors have been unable to find solutions to the many hard problems with which the trade is faced.

Landwirtschaftliche Samenkunde. — (Dr. Ludwig Wittmack. Berlin: Paul Parey, 1922, pp. viii. 581.) This is a second edition of the writer's "Gras- und Kleesamen" published as far back as 1873. After some forty years of teaching, retirement has afforded the leisure to produce what is practically a new book. It is divided into two sections—(1) General, to page 112, and (2) Special, pages 112 to 513. In the former, the trade in agricultural seeds and seed control, with the machinery used in cleaning and the apparatus used in testing are dealt with, and the biology of seeds generally discussed. In the special section the various species are dealt with individually—grasses occupying some hundred pages, and leguminosae about eighty. The more important economic plants are described, notes are added as to pathology and chief countries of origin, and liberal references to literature given. Papers as late as those of Hernfrid Witte on the colour of red clover seeds, and of E. Lindhard on natural and artificial breeding of red clover (both 1921) are noted in the body of the work, while in the "Addenda" dates as recent as 1922 are to be found. The book is well and fully illustrated and should prove of considerable value. There is a full index and an excellent bibliography.

Die Kultur der Wiesen.—(4th Edition. Professor W. Strecker. Berlin, 1923, pp. 502); and **Erkennen und Bestimmen der Wiesengräser.**—(9th Edition. Professor W. Strecker. Berlin, 1923, pp. 250.) These two books supplement each other. In the former practically everything involved in the establishment and care of meadows is discussed—clearing, drainage, irrigation and overhead watering, and fencing occupy the first 150 pages. Then follow renovation, laying down to grass and manuring. A chapter on the care of meadows deals with animal and insect pests (a strong plea is put up for the mole), weeds and methods of cultivation, rolling, harrowing, etc. The last hundred pages comprise harvesting and conservation as hay or silage. The writer is an enthusiast—his motto is "Better grassland, more cattle—more cattle, more manure and consequently better arable." He leans to rotation as opposed to permanent grass as giving scope for the introduction of new and improved varieties.

The smaller book may be described as a manual of grasses. It is, like the larger, fully illustrated, and contains useful tables, grouping the various grasses under such heads as top grasses, bottom grasses and so forth. Specimens of seeds mixtures for meadows and pastures, under various conditions, are given.

Egg-in-Kums.—(By "Sonimor." The "Sonimor" Egg Farm, Leckhampstead, Newbury. Berks, 1923, XV + 120 pp. 43 illus. Price 5/-.) Mr. Hector Morison has here presented a very readable account of the equipment and methods of commercial egg farming in use at the "Sonimor" Egg Farm. He is an enthusiastic advocate of large flocks both for laying stock and chicks, and he explains that the methods advocated in his book apply only to large units. The opinion is expressed that there need be no limit to the size of the flock or houses provided that the building and organisation are right. The author believes that the use of modern labour-saving appliances is justified by the increased efficiency of the attendants and the greater interest which they take in their work. Nine workers do everything on the farm including incubating and chicken rearing. He finds that 1½ workers per 1,000 adult stock are ample for all purposes.

The farm is run for the sole object of egg production and for this purpose the White Leghorn is strongly recommended.

Descriptions are given of the construction and equipment of the incubator house, brooder house, colony houses, cockerel houses, laying sheds, breeding sheds, and granary. A granary attached to each house to hold one week's supply is found to minimise labour in feeding. These chapters are illustrated with photographs which show clearly the construction, arrangement, and fittings, and plans are given. Two mammoth incubators of 6,000 egg-capacity are installed. The large brooder house accommodates 5,000 chicks in units of 500. A light blue colouring in the brooder house is recommended as a preventive of toe-pecking. The methods employed in incubating and brooding are fully described and many interesting comments are made.

Over 30,000 chicks are hatched each season. The pullets are drafted from the brooder to asbestos colony houses accommodating 150 to 200. They are allowed to perch at once.

Two sizes of laying sheds are in use. The larger ones, housing 1,500 birds, are 400 ft. long and 16 ft. wide : the smaller houses, 160 ft. long by 14 ft. wide, accommodate 500 layers. Each house is built in the centre of a plot of land, the northern portion of the plot being used in summer and the southern in winter. The northern plot is larger because birds are out more in summer than in winter. About an acre of land is allowed to every 500 birds.

Mr. Morison has recently been experimenting with the use of electric light in his pullet houses from dusk to 7.30 p.m. He finds that the extra cost of light is much more than balanced by the increased winter egg-yield. Dry mash is fed to both old and young birds. Interesting chapters are given on the water supply, egg packing, collecting and storing, and business methods in commercial egg farming.

The stock of adult birds numbers 6,000, made up of 3,000 pullets, 2,000 second season birds, and 1,000 three year olds. Mr. Morison has kept records which show that his pullets will average 150 to 160 eggs per bird per year, second year birds 130 to 135, and third year birds 120 to 125. He maintains that it pays to keep birds at least three years and gives figures in support of this contention. His basis of calculation, however, is 2s. 6d. per dozen in each case and no allowance is made for winter eggs laid by the pullets. It is assumed that anyone farming on a really commercial basis will need at least 2,000 laying stock. The cost of raising this number and purchasing the necessary equipment is estimated at £3,500. Twenty or thirty acres is mentioned as a useful size for a farm and some hints are given on the choice of situation.

This book is a valuable addition to the poultryman's library, which is sorely lacking in books devoted entirely to poultry farming. It is sure to be read with interest by all engaged in egg farming.

The British Goat Society's Year Book.—(British Goat Society, 5, Fenchurch Street, E.C.3. Price 1s. 6d.) The third year book of the British Goat Society (Mr. T. Palmer, Honorary Secretary) contains more than twenty articles by well-known goat breeders, as well as articles by medical men, veterinary surgeons and others. There was recently a special importation of goats from the Continent* and a detailed account is given by Mr. Palmer of the difficulties which were overcome in the search for suitable stock in Holland and Switzerland. Mr. Holmes Pegler gives a history of previous importations in old days, with amusing accounts of how the regulations governing importation were occasionally evaded.

Dealing with the value of goats' milk for children, Dr. Ker Bell says : "When cows' milk is prescribed for bottle feeding it is generally diluted with water, lime water or barley water, and this does not appear necessary in the case of goats' milk, which is soon tolerated undiluted." Dr. W. R. Hadwen in his article on "Malta fever and Goats' Milk" refutes the stigma generally attached to goats' milk in this connection and attributes the decline of fever to removal of insanitary surroundings.

On the veterinary side of goat keeping, Mr. H. Stainton writes on "Sterility" and says that there are three general factors which militate against productiveness in any animal, namely unnatural conditions, inbreeding, and intensive breeding, such as that carried out for the purpose of heavy milk production.

Dr. F. A. E. Crew has carried out research work on "Developmental Intersexuality in the goat" at Edinburgh and gives the results of his investigations. The volume is illustrated with numerous photographs, and contains the Rules and Regulations of the Society and a list of the names and addresses of members.

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* See this *Journal*, February, 1923, p. 1023.

ADDITIONS TO LIBRARY.

Agriculture, General and Miscellaneous.

Hendrick, J.—The Farmer's Raw Materials: Air, Water, Soil and Manure. (211 pp.) Edinburgh: W. Green & Son, Ltd., 1923, 6s. net. [63.11(02); 63.16(02).]

Löhnis, F., and *Fred, E. B.*—Textbook of Agricultural Bacteriology. (283 pp.) New York and London: McGraw-Hill Book Co., 1923, 15s. net. [576.8(02).]

Cutler, D. W., *Crump, L. M.*, and *Sandon, H.*—A Quantitative Investigation of the Bacterial and Protozoan Population of the Soil, with an Account of the Protozoan Fauna. [Philosophical Transactions of the Royal Society of London, Series B, Vol. 211, pp. 317-350.] London: Harrison & Sons, 1922, 4s. [63.115.]

Shaw, Sir Napier.—The Air and its Ways: The Rede Lecture (1921) in the University of Cambridge, with other Contributions to Meteorology for Schools and Colleges. (xix + 237 pp. + 24 plates.) Cambridge: University Press, 1923, 30s. net. [551.5.]

Carrier, L.—The Beginnings of Agriculture in America. (xvii + 323 pp.) New York and London: McGraw-Hill Book Co., 1923, 14s. 6d. [63(73).]

Field Crops.

Strecker, W.—Die Kultur der Wiesen ihr Wert, ihre Verbesserung, Dungung und Pflege. [4te. Aufl.] (502 pp.) Berlin: Paul Parey, 1923. [63.33(*a*).]

Strecker, W.—Erkennen und Bestimmen der Wiesengräser im Blüten- und blutenlosen Zustande sowie ihr Wert und ihre Samenmischungen für Wiesen und Weiden. [9te Aufl.] (250 pp.) Berlin: Paul Parey, 1923. [63.33(02).]

University College of Wales, Welsh Plant Breeding Station.—Bull. 3, Series C., Seasons 1921-22:—Preliminary Investigations with Oats. (59 pp.) Aberystwyth, 1923, 5s. [63.314.]

Ontario Department of Agriculture.—Bull. 296:—Sweet Clover. (16 pp.) Toronto, 1923. [63.33(*b*).]

U.S. Department of Agriculture.—Bull. 1146:—The Influence of Copper Sprays on the Yield and Composition of Irish Potato Tubers. (26 pp.) Washington, 1923. [63.295(04); 63.512(04).]

Cornell Agricultural Experiment Station.—Memoir 57:—A Study, by the Crop Survey Method, of Factors influencing the Yield of Potatoes. (140 pp.) Ithaca, 1922. [63.512(04).]

Plant Diseases.

Nebraska Agricultural Experiment Station.—Bull. 186:—Potato Diseases in Nebraska. (32 pp.) Lincoln, 1923. [63.21; 63.23; 63.24-33.]

North Dakota Agricultural Experiment Station.—Bull. 166:—Diseases of Grain and Forage Crops in North Dakota. (92 pp.) Agricultural College. N.D. 1923. [63.24-31; 63.24-33.]

Anderson, O. G. and *Roth, F. C.*—Insecticides and Fungicides. Spraying and Dusting Equipment: A Laboratory Manual with Supplementary Text Material. (xvi + 349 pp.) New York: John Wiley; London: Chapman & Hall, 1923, 15s. net. [63.294; 63.295.]

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Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W. 1.

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OF THE
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Vol. XXX. No. 5.

AUGUST, 1923.

NOTES FOR THE MONTH.

Agricultural Advisory Committee and the Imperial Economic Conference.

At a recent meeting of the Agricultural Advisory Committee for England and Wales, it was agreed that a sub-committee of that body, consisting of Lord Bledisloe, Mr. J. T. McLaren, Mr. R. R. Robbins, Mr. W. R. Smith, and Mr. C. D. Thompson, with power to co-opt two other members representing the Agricultural Committee of the House of Commons, should be appointed to advise the Minister on matters affecting agriculture which may arise at the Imperial Economic Conference to be held in London in the autumn. The committee held its first meeting yesterday, with the Right Hon. Sir Robert Sanders, M.P., Minister of Agriculture, in the chair. The two representatives appointed by the Agricultural Committee of the House of Commons are Captain the Right Hon. E. G. Pretyman, M.P., and Mr. Percy Hurd, M.P.

* * * * * *

The Royal Show at Newcastle.

There is, of course, no place where such a fine display of British cattle is to be seen as at the Royal Show. As an exhibition this year's show was as wonderful as ever. It is true that in some sections the numbers were small, and, as is usually the case, there was considerable variation in merit in the exhibits in some of the classes. As is also usual, however, the general standard of quality was high, and, as always, there were in most sections some cattle of a merit scarcely to be excelled. The standard in this country is a high one, and it is hardly necessary to say that it was in every sense maintained by those who had been appointed for the Show at Newcastle to the distinguished, but often difficult, office of making the awards. Here and there could be seen what a judge would regard as common, though not inferior, but there was also to be noted the perfection of form and grace of outline that are the delight of

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the breeder's eye as well as that of the mere spectator, whose point of view may be far different.

There are many points that strike the observer at any Royal Show, and it is not, of course, the same points that strike all. This year, one feature of the Show was the great display of Shorthorns, including Dairy Shorthorn, and of British Friesians. The counties of Northumberland and Durham are indissolubly associated with the Shorthorn from its earliest history, and visitors to the Show, no doubt, expected to see the famous breed appearing in force in the country of its origin. They did not perhaps expect to see such a show of Friesians, and many of them must have been surprised by the display that was made by this breed. Numerically, the Friesians came next to the Shorthorns, a remarkable testimony to the present popularity of the breed, and, when it is remembered that at the previous Royal Show at Newcastle the breed was not represented at all, it is a no less striking comment on the rapidity with which Friesian cattle have won favour with breeders in this country.

Another feature that attracted attention was the improvement in both Dairy Shorthorns and Friesians in the direction of greater uniformity of type and the dual-purpose character of that type. Improvement in this sense is perhaps a matter on which there may be a wide difference of opinion. To the breeder anxious to possess a cow that is a good milker, but who has to cater for the store cattle market with yearlings that show promise of growing into weighty, well-fleshed steers, it is unquestionable that the type of Dairy Shorthorn exhibited a few years ago left much to be desired. So it was also with many of the early Friesians. Now, in both breeds and among both males and females, there is a noticeable change in conformation, though not yet uniform, which seems to indicate a definite trend towards the breeding of a type of animal, which, having a high milk record, will also prove useful to the grazier. Experience has shown that there is no reason why a cow that is a good milker should not also be a good-looking one. For the ordinary farmer, a general-purpose breed is the most likely to retain favour permanently, and the present tendency in these two breeds, which are singled out for mention here for the simple reason that they were the most numerously represented at the Show, is as interesting as it is significant. Two other breeds, for which a general-utility character has always been claimed, that showed themselves to such advantage as to be remarked upon at the Show were the Lincoln Reds and the Red Polls.

The visitor who attends the Royal Show with the object of seeing the high standard of excellence to which British breeds of cattle have generally attained, found this year, as always, much in all classes, no doubt, to impress him. To the observer of tendencies in the development of breeds, it may perhaps be said that the most striking feature of the cattle section was the direction in which the improvement of two well-known milking breeds is tending and the remarkable uniformity of type which that tendency is producing.

The poultry section at the Royal Show is always good, and was up to its normal standard this year. A new note in recent shows has been the rabbit section, undoubtedly due to the now fashionable use of the finer self-coloured rabbit furs in place of the dyed and treated commoner types sold under various trade names.

A huge collection of agricultural machinery and implements, seeds, fertilisers, buildings and other farm requisites. would provide any farmer with a choice suitable for any conditions or any climate or soil, and formed a most impressive display.

In regard to agricultural and rural education the remoteness of Newcastle from the southern parts of England doubtless led to a much smaller exhibit than usual. In the agricultural education building the Meteorological Office seemed to be very popular with visitors, and indeed it had a good deal to show. The Agricultural Education Association showed how it endeavours to forward agricultural education; and the Fur Board dealt with inquiries in regard to the rabbit fur industry, showing a variety of fur products. The principal space, however, in this section was devoted to the Agricultural Department of Armstrong College, which had a very full exhibit. In one bay were shown various specimens in connection with the management of grass land. Turves cut from the experimental plot at Cockle Park proved a source of great interest to a large percentage of the visitors, and many comments were made on the striking effect of finely-ground mineral phosphates on grass land lying on a poor clay soil.

In a second bay various specimens were shown in connection with animal husbandry, and a set of hides lent by the Newcastle Hides Improvement Society, showing the damage done by warble fly, attracted much attention.

The Cumberland and Westmorland Farm School, Newton Rigg, Penrith, combined with Armstrong College to exhibit examples of dairy work and matters of general interest in connection with dairying and horticulture.

Other bays contained specimens of crops showing the effect of various plant diseases. The College, in conjunction with the Royal Agricultural Society, provided an exhibit of photographs, prints and paintings showing the development of the various breeds of Northumbrian sheep from about 1780 till the present time. The breeds included the Blackfaced, the Cheviot, the Border Leicester and the various cross-bred sheep in the north. These two bays were in charge of Professor Gilchrist and Alderman Parlour of Darlington.

In a part of the show-ground adjoining the cattle sheds were given a series of clean milk demonstrations of considerable educational value, from the cleaning of an actual cow's udder to the final distribution of the milk.

A word in conclusion might usefully record that the Ministry's own exhibit proved far from unattractive to a large number of visitors. It dealt with clean milk production, silos, model cottages, model cow-houses, etc., seed-testing, harmful weeds, potatoes immune from wart disease, bee-keeping, rat destruction, manuring of grass land at Rothamsted, and pests of farm and garden crops. In addition its publications stand for the sale of this *Journal*, leaflets, and other publications, was kept very busy.

* * * * * *

Inheritance of Milk Yield.

IN the issue of this *Journal* for December, 1921, p. 769, reference was made to the results of an investigation carried out at the Maine Agricultural Station with the object of ascertaining the influence of the dairy bull on the milk yield of his daughters. It was shown that when an analysis was made of the "Advanced Register of Dairy Bulls" maintained by the Jersey Breed Association, the fact emerged that, out of 200 bulls the records of whose daughters were available, approximately one half sired daughters whose records surpassed those of their dams.

The results of a similar investigation in relation to the Holstein-Friesian breed have now been published,* and are worthy of mention, agreeing as they do with the results obtained in regard to the Jerseys. An examination of the Advanced Register of this breed showed that there were 111 Holstein-Friesian sires having two or more daughters with recorded yields. Of these, 65—or roughly one-half—raised the milk yield of their daughters over that of the dams of these daughters. The list was headed by a bull which on an average raised the milk yield of his daughters by 7,640 lb.; another raised the milk yield of 14 daughters on the average by 4,860 lb.

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* Maine Agricultural Experimental Station, 37th Ann. Rept., Orono. Maine. 1921, pp. 251 *seq.*

These figures are independent of any theory: they show clearly how important an influence the sire exercises on the performance of his daughters. They demonstrate, moreover, that pedigree by itself is not a guarantee of performance: pedigree makes performance more likely, and it appears to be an even chance whether a pedigree sire will raise the level of the herd or not. Although the probability that he will maintain it at the same level is greater, still the fact remains that he sometimes lowers it and that the best test of the milking quality of a sire is provided by the records of his progeny. It is, therefore, to be deplored that, for reasons which appear to be peculiar to this country, the prevalent practice is to slaughter the dairy bull before the records of his daughters are available. (A reference to the Swedish practice of keeping bulls until the performance of their progeny is available, is made by Sir Daniel Hall at p. 397.)

* * * * * *

The Growing of Medicinal Herbs.

DURING the past nine months, the Ministry has received numerous requests for information on the growing of medicinal plants; and, in consequence, it was considered desirable to make inquiries, in conjunction with the Ministry of Health, to ascertain if there had been any material alteration in the position of this industry since the previous inquiry in 1916. Following a Conference with the National Health Insurance Commission (England) in that year the Ministry of Agriculture came to the conclusion, reported in the issue of this *Journal* for February, 1917, that there was not sufficient scope in the total quantities required of medicinal plants to justify it in making recommendations which might tend to encourage, or even mislead, a certain class of person into taking up the cultivation of medicinal herbs as a source of livelihood. Leaflet No. 288, which had been issued since 1914, giving particulars of some of the various medicinal plants, was accordingly withdrawn, it being felt that the circulation of such a leaflet would imply that herb growing could be regarded as a remunerative commercial possibility.

The result of the present inquiry shows that the position remains unchanged. It appears that there are abundant supplies of medicinal herbs available at the present time, and that there are no grounds for apprehending any shortage in the future. The supplies are chiefly derived from overseas, and the prices approximate, generally, to those obtaining before the War. In view of the large quantities of low-priced herbs obtainable from abroad, it seems unlikely that the extended production of medicinal herbs in this country would be successful as a commercial undertaking, except, perhaps, on the part of those who have exceptional opportunities for disposing of their products, such as wholesale druggists growing their own herbs; or of those whose production of herbs forms but a small part of their total output of horticultural produce, and who can increase or reduce the areas they devote to herb growing in accordance with market requirements. While some of the medicinal herbs grown in this country are believed to be of superior medicinal quality to those obtained from abroad, the difficulties and expense of collecting small quantities grown in scattered situations, and of properly drying them, would appear to preclude individual small growers from selling their herbs profitably in a limited market already well supplied with foreign produce dried under more favourable climatic conditions.

* * * * * *

Prizes for Well-Cultivated Farms.

A paper containing proposals for increasing the average yield of farm crops by a system of farm competitions was read before the International Congress of Agriculture which was held in Paris in May, 1923. The author, Monsieur H. Miserez, of the Belgian Ministry of Agriculture, pointed out that the means by which the present day yield can be increased are already well known and are practised by a number of cultivators. Heavier and more intelligent manuring, the improvement of the physical condition of the soil by suitable cultivation, the use of improved seed, prevention of plant diseases, etc., have produced a steady rise in the average yield of crops during the last forty years. In order to push production to the maximum possible a wide propaganda is necessary, in order to ensure the adoption of the improved methods by all cultivators. For this purpose competitions for farm crops should have as great an influence as has been exerted on animal breeding by live stock shows or competitions. The author suggests that such competitions should be organised on a large scale by local agricultural authorities and by agricultural associations, with the collaboration of agricultural colleges, etc., and the assistance of the State. The manner in which they should be organised and the form of assistance by the State or by local authorities would naturally depend upon the conditions of different countries, but some principles of general application are laid down, viz., comparatively large prizes should be offered, which would be open to all farmers in the district cultivating more than a prescribed acreage. A Committee of Judges would visit each farm, to award the prizes and also to give the competitors advice and instruction on the spot. Great publicity should be given to the awards, and the finest crops should be reserved for distribution in the district as seed. The popularisation by this means of improved varieties and strains is regarded by the author as one of the most important results to be aimed at.

* * * * * *

Fertilisers and Feeding Stuffs Act Committee.

The Minister has appointed a small Departmental Committee to inquire into the operations of the Fertilisers and Feeding Stuffs Act, 1906, to advise whether any, and if so what, amendments are necessary in order to render the execution of the Act more economical and effective, and to report accordingly.

The Committee consists of the following:—

Lord Clinton (Chairman).
Mr. E. Richards Bolton, F.I.C., F.C.S.
Mr. E. G. Haygarth Brown.
Dr. Charles Crowther, M.A., Ph.D.
Mr. Thomas Kyle.
Mr. Brian S. Miller.
Mr. George Stubbs, C.B.E., F.I.C.
Dr. J. F. Tocher, D.Sc., F.I.C.
Dr. J. A. Voelcker, M.A., Ph.D., F.I.C.

Mr. H. J. Johns, of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W., has been appointed Secretary to the Committee.

* * * * * *

Inspection of Potatoes for Planting.

All growers of potatoes who may desire to sell any of the crop for planting should bear in mind that the Wart Disease of Potatoes Order of 1923 requires all potatoes sold for planting to be officially certified.

The certifiates are of three kinds: (1) that the potatoes have been grown on land believed by the Ministry of Agriculture to be free from Wart Disease; (2) that the crop has been inspected and that on such inspection Wart Disease was not found to exist; and (3) that the potatoes were inspected whilst growing and were found to be of an approved immune variety, true to type and reasonably free from "rogues."

Certificate (1) can be issued direct from the Ministry in respect of the land in the greater part of England outside the main infected area. In the case of land which is near a known case of Wart Disease inspection of the crop may be necessary, and certificate (2) will be issued if this inspection is satisfactory. Growers of immune varieties should arrange to have their crops inspected so that a certificate (3) may be issued.

Only potatoes with this latter certificate are allowed to be planted in land infected with Wart Disease, and, moreover, it is in the interests of growers generally that the stocks of the immune varieties should be pure and free from "rogues."

The inspection for purity must be made while the crop is still growing, and applications for inspection should be sent to the Ministry as soon as possible, as after the crop has died down the necessary inspection cannot be made.

* * * * * *

The Agricultural Index Number.

OWING mainly to the reductions in the prices of fat sheep and milk, the general index number of the prices of agricultural produce has declined from 54 per cent. above pre-war in May to 51 per cent. above in June. The fall would have been more noticeable but for the fact that British fruit, which was selling at nearly double the pre-war price in June, is now included in the general figure, after being off the market since early in the year. During the last five months prices of agricultural produce generally have been about 10 per cent. below those of the corresponding month of last year.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

Wheat and oats realised 1d. per cwt. more than in May, but barley was 8d. per cwt. cheaper. Oats usually appreciate in price during June, and barley prices usually decline whilst wheat remains stationary, so that the index figure of oats was reduced by 1 point whilst those of barley and wheat each advanced by 1 point. Potatoes rose very slightly during June, when there was a rather better demand at some markets for King Edwards, but the rise was relatively less than before the war and the index number declined to 31 per cent. below the pre-war price. Hay was 42 per cent. dearer than in June, 1911-13, and the decline in prices throughout the present year having been normal, the index figure has remained about the same since January.

The average price of fat sheep was 2d. per lb. lower than in May, and 83 per cent. above the pre-war price, a decline of 20 points on the month. Fat sheep are therefore relatively cheaper than in any month since January last and 17 per cent. below June, 1922. The reduction of 2d. per stone in the price of fat cattle as compared with May was relatively much the same as in pre-war years, but the fall of 5d. per stone in the case of fat pigs was relatively greater than before the war. Fat pigs were 69 per cent. dearer than in June, 1911-13, against 72 per cent. dearer in May, whilst fat cattle only declined by 1 point from 53 per cent. to 52 per cent. above pre-war.

Dairy cows were about 10s. per head cheaper than in May, but remained at 50 per cent. above the pre-war price. Store cattle were also cheaper than in May, but store sheep and pigs, though declining in price, were relatively dearer than in the previous month, the fall in June being relatively less than in 1911-13. Whilst store cattle were cheaper than in June, 1922, store sheep and pigs were appreciably dearer than a year earlier.

With the low price of 7¾d. per gallon payable for milk sent by producers in excess of their basic quantities, very little surplus milk has been forwarded, so that the average price of milk sold under contract in the London and Birmingham areas shows no change from last month, but owing to a much larger proportion of the milk sent to the Manchester district being sold at 10d. per gallon, the average over all has declined from 63 to 53 per cent. above pre-war; even so, contract milk generally is about 20 per cent. dearer than in June last year. Butter declined by 1½d. per lb. and was only one-third above the pre-war price, but the decline in cheese was relatively less than in 1911-13, so that the index figure is 2 points higher than last month. Eggs were dearer, but were only 40 per cent. above 1911-13 against 69 per cent. in June of last year.

The following table shows the average increases during recent months in the prices of the principal commodities:—

Percentage Increase as compared with the Average Prices ruling in the corresponding Months of 1911-13.

	1922.	1923.				
Commodity.	June	Feb.	Mar.	Apr.	May	June
Wheat ...	60	28	27	31	37	38
Barley ...	58	12	8	11	16	17
Oats	57	39	36	39	42	41
Fat cattle ...	71	61	54	51	53	52
Fat sheep ...	121	97	94	100	103	83
Fat pigs ..	82	88	77	71	72	69
Dairy cows ...	64	67	58	55	50	50
Store cattle ...	40	36	31	29	33	31
Store sheep ...	88	100	92	92	98	114
Store pigs ...	97	154	136	131	126	130
Eggs... ...	69	46	55	37	43	40
Poultry ...	116	80	81	75	77	87
Milk	28	90	87	70	63	53
Butter ...	59	72	70	68	40	33
Cheese ...	55	88	95	92	42	44
Potatoes ...	80	—5*	—12*	—28*	—28*	—31*
Hay	35	42	42	40	41	42

* Decrease.

* * * * * *

Conciliation Committees in Agriculture.

The Minister of Agriculture has presented to the House of Commons a Bill to facilitate the confirmation of wages agreements reached by Conciliation Committees.

The Bill provides that the Minister's powers under the Corn Production Acts (Repeal) Act, 1921, to confirm a rate of wages agreed upon by a Conciliation Committee may, in the case of an agreement made after the passing of the Bill, be exercised on application in writing by a majority of either side of a Committee (instead of as at present only on application by a Committee as a whole).

Section 2 of the Bill provides that a Committee's power to issue a certificate that a contract for the payment of wages to any particular worker at a lower rate than the rate agreed by the Committee is fair and reasonable having regard to the special terms of the contract, shall be extended to enable the Committee to grant such a certificate in respect of all workmen employed on the same special terms in the area.

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AGRICULTURE IN SCANIA.

SIR DANIEL HALL, K.C.B., LL.D., F.R.S.,
Chief Scientific Adviser and Director-General of Intelligence Department, Ministry of Agriculture and Fisheries.

IN June of the current year, Mr. M. W. F. de Wachenfelt, Agricultural Adviser to the Swedish Legation, organised a tour of British agriculturists in southern Sweden and invited the participation of representatives of the leading agricultural organisations in England and Scotland. A party of 15 left London on June 11th and were joined later by Sir Douglas Newton and Mr. German of the National Farmers' Union.

The party travelled by way of Esbjerg and spent their first day in Copenhagen, where they visited the Royal Veterinary and Agricultural School and the Seed Testing Station. The reputation of the College, which was founded as long ago as 1858, is world wide; one was impressed by the completeness of the equipment and the evidence of continued extension, still in progress. The College is situated in Copenhagen itself, and the course of instruction embraces nothing of what would be called in this country "practical work" upon a farm, but the students, of whom there are now over 500, are not admitted unless, in addition to a satisfactory general education, they have had three years' previous experience upon a farm. Thus a high standard of instruction both in agriculture and in the sciences bearing upon it can be maintained. Both here and at Alnarp, the Swedish college that the party visited later, the most notable comparison with British colleges lay in the completeness of the technical equipment for dealing with subjects like agricultural machinery and the industries connected with agriculture, such as dairying and distilling; there was every provision for the fundamental preliminary training of factory managers. The party was entertained to lunch by Dr. Ellinger, the Director, and his staff, and then went on to the Seed Testing Station, where it was received by the Director, Dr. Dorph Petersen.

Copenhagen possesses the oldest seed testing station in the world, and its methods have become classical. Perhaps the most interesting feature is that seed control in Denmark is not enforced by law but is a voluntary control into which all the great seed firms of the country enter. Briefly put, the guarantee given by the seed merchant covers the strain of seed as well as its purity and germination, and the control takes its own measures to check the guarantees, not necessarily at the instance of the purchaser. The control also regulates the procedure to be followed when a sample proves deficient and compensation has to be paid to the purchaser. To those who know Dr. Dorph Petersen it is unnecessary to insist on the impression he made by his enthusiasm and his kindness.

Farming in Scania.—From Copenhagen the party crossed to Malmö, which became its headquarters during the next three days spent in excursions in Scania, the southern and most highly cultivated province of Sweden.

The country is low, gently undulating, covered with a soil of glacial origin and generally of a light freely-working nature. No hedges are to be seen, woodlands only upon the hills, and the whole country is under the plough. Save for some marshes by the sea the only permanent grass that was seen was one great area of meadow occupying the bed of a reclaimed lake. Except for an occasional boggy patch and pond in an undrainable depression, such as are characteristic of glaciated areas, there was no waste land; cultivation came right up to the roadsides. The other characteristic of the landscape was the high-tension cables that traversed the land, with the occasional towers containing transformers, carrying current to all the farms for light and power purposes from the great water power station at Trolhatten some 400 miles away. The main crops were wheat, barley, oats and rye, the latter to almost as great an extent as the other cereals; sugar beet, with other root crops less prominent; red clover and a grass mixture in which cocksfoot showed up strongly; also a certain proportion of a mixture of peas and barley for fodder purposes. As in all north-west Europe the crops were in need of warmth and sunshine.

The most striking feature was the general uniformity of the farming; not only were all the farmers growing the same crops in the same way, but a high level of cultivation was very evenly maintained. Some districts were better than others as the soil varied, but one did not pass suddenly from a good to a bad farm as is so often the case in England. Very few stock were to be seen in the open; some of the farmers had begun to graze their leys, the milch cows being tethered in a long line so as to advance uniformly over the field, but in a large number of cases the cattle remain indoors throughout the whole year. This naturally involves extensive buildings, which in the majority of cases were modern, airy, well-lighted structures with the standings for the cows, the bull pens and calf pens under the same roof. All the crops are brought under cover, the barns on the large farms being of vast dimensions. The system of farming is founded upon corn-growing and dairying on the soiling plan, with pigs as the secondary live stock, though not in all cases. Sheep were but little seen. Sugar beet was important within the zones of the sugar factories; in a few instances it was used for distilling. The cattle in Scania were nearly all Swedish Friesians, perhaps a little smaller but not differing essentially in type from the Friesian as we know it. For many years milk recording has been general and breeding and selection have been founded upon the records with the result that a very high average level of performance has been attained, this being regarded as of more importance than record performances of individual cows. But the sort of average results obtained may be judged from the following results in 1921-22. The Alnarp College herd, 153 cows in milk, average yield 9,020 lb., with 3.2 per cent. of butter fat; Baron Ramel's herd, 104 cows in milk, average yield 9,160 lb., 3.25 per cent. butter fat; Mr. Stjernswärd's herd, 91 cows in milk, average yield 10,060 lb., 3.56 per cent. butter fat; Baron Blixen Finecke's herd, 135 cows in milk, average yield 10,250 lb., 3.4 per cent. butter fat; and the Bondesson herd of about 50 cows in milk, average yield 10,800 lb., 3.5 per cent. butter fat. Some of the smaller herds gave remarkable results; for example, a herd of 14 cows only, which in 1921-22 gave an average yield of 17,540 lb. with 3.57 per cent. of butter fat. The other breed prevailing in this part of Sweden, though as a rule associated with the poorer land, was the Swedish Ayrshire, which from an original Scotch stock has been developed to a larger size, coloured almost all over. Again it is being bred mainly upon lines dictated by milk records.

One striking feature was the docility of the bulls; we saw bulls still in use up to 11 years old, a practice which is very helpful in breeding for milk, for the bull is still available when the performance of his progeny can be seen. Again at the Gothenburg show there were classes for groups of cows and a bull, all tied up in a row without partitions.

In connection with cattle breeding, perhaps the most interesting sight was at Simlinge, the centre of a Bull Society founded in 1902. The small farmers who constitute the society own two bulls, and the members had assembled by the roadside for the party's inspection a selection from their respective herds—the two bulls, and some younger bulls going to the annual sale of pedigree stock at Malmö, cows in milk and heifers, the progeny of the Society's bulls. The cows, all registered, were perhaps a little smaller and shorter in the leg than the show specimens of the breed, but were typical farmers' cows with a very high level of performance. It was a member of this society whose herd gave the remarkable results recorded above.

Many of the larger herds were tubercule free, and very special precautions were taken to avoid infection, some of the owners, for example, would not keep pigs on the same farm.

Pigs were of the large or middle white class, pure bred or crosses of the native breed with large white boars. The bacon factories, of which we saw an example at Trelleborg, insist upon a uniform type for the export market, and this factory issued a monthly leaflet dealing with points of feeding and breeding.

An interesting feature of the farming of Scania is that the system of tenure is not unlike our own. It is not a country of small holdings, and though in some districts small occupier-owner farms predominated, more generally it is a country of large estates, divided into rented farms of varying size, even up to 1,000 acres, held as a rule on lease. The landowners take a leading position in the farming of their estates and in the organisation of co-operative societies, bacon factories and the like. The home farm is generally of considerable size and is farmed on strictly business lines.

Rents, we were told, are about 30s. an acre; wages are about the same as in the north of England and Scotland, equivalent to 36s.-40s. a week but longer hours are worked than in England. On some of the estates there are cottages with about 5 acres of land, the occupiers of which put in two or three days a week as labourers upon the estate. The world's break in prices had caused great farming losses in Sweden as elsewhere, the worst of the depression having been experienced last year. We were told of the perilous position of many men who had bought and stocked farms in the period of exaggerated prosperity towards the close of the war; nor were the sellers much better off for the high prices they had received, because they had invested their money in industrial securities which had dropped enormously in value and were yielding no income. The sound men were those who had held on their way during the war, neither buying nor selling.

With this brief account of the general impression made by the farming of Scania we may now turn to some points of more specific interest.

The Malmö Agricultural Society.—The Malmö Agricultural Society by which the party was received on its arrival, is typical of the organisations through which much of the work of agricultural improvement is carried on in Sweden. It is a private corporation but the greater part of its income is derived from the State, the Society being the agency employed for the provision of advice to farmers and the organisation of societies for such purposes as milk recording, improvement of live stock, improvement of seed, etc. State loans for such purposes as the building of cottages pass through the hands of the societies, which indeed in a large number of cases fulfil the function, vis-a-vis agriculture, of the Local Authorities in Great Britain. The Society possesses in Malmö a large building with a meeting hall, library, offices and laboratories. The Society owns the adjoining Market Hall where the regular weekly sales of the live stock of the district are held as well as the annual sales of pedigree stock from the milk recording and breeding societies. The Society derives a considerable annual income from its market. The Society's buildings contain veterinary laboratories, the officers of which are partly employed in the control connected with the market, and partly in investigation and the preparation of serums for use in dealing with the various cattle diseases that cause trouble in the district. Here, too, are housed the offices, store rooms, etc., of the Scanian Butter Export Society. All butter passed for export is examined here for packing and weight, the control as regards quality, water content, etc., being exercised by surprise inspections and analyses of the products of the dairies within the control, who alone have the right of putting the State brand upon their produce. The Society employs a staff of advisers who deal with the farmers either as regards general advice on their farming or such specific matters as the control of the herd books and milk records. This method of conducting so much of the work of education and agricultural improvement through the Agricultural Societies is justified as keeping such matters out of the sphere of politics, either local or national, and in the hands of the farmers themselves.

Alnarp Agricultural College.—At Alnarp the party visited the great Agricultural College, one of two in Sweden. It is an extensive institution founded about sixty years ago and includes the Agricultural College proper, the Horticultural College, the Agricultural School, a Dairy School and a School for instruction in Horse Shoeing. The College gives a two-year course of higher instruction of a theoretical character for the training of the larger farmers and estate managers, officials ("agronomes"), etc., and entry is limited to those possessing a sound general education. In the School the course of instruction is shorter and includes practical work for the training of bailiffs and small occupiers. The institution possesses a farm of about 1,200 acres with a herd of some 300 Swedish Friesians, a thoroughly well-managed farm typical of the agriculture of the district, large enough not to have its economy disturbed by subservience to the educational requirements of the College and School. The Dairy School is also engaged in the testing of all forms of dairy machinery and appliances, thus ensuring that the factory manager in course of training becomes acquainted with the most recent forms of machinery.

Winter Schools of Agriculture.—In connection with education we may also mention the Winter Schools of Agriculture of which we saw an example at Hvilan, near Alnarp and another at Fridhem, by Svalöf. To quote from the very excellent descriptive itinerary prepared for the party, "In Scania it is customary for the sons of average farmers, a few years after leaving the primary school to pass through a course at the High School at which instruction is given in general education; and afterwards a course at an Agricultural School, where special agricultural knowledge is acquired. Each course embraces one winter." The school at Svalöf was a handsome building rebuilt in 1920 and it is noteworthy that the whole of the funds required for its erection were obtained by private subscription from the farmers in the district, since the State assistance does not extend to capital but only to maintenance. The building contained classrooms, library, and laboratories on the ground floor, with the hostel above, each student having a room to himself.

Institute for Research in Breeding.—Adjoining the Alnarp Estate is the Institute for Research in Breeding belonging to the University of Lund. Here the party was received by Dr. Nilsson Ehle, so well known for his investigations in the breeding of wheat, of which "Swedish Iron" is an outcome now well known in England. Dr. Nilsson Ehle gave the party an address on the objects and methods of plant breeding, with special reference to wheat, which was a model of clear exposition, especially considering that he was speaking in an unfamiliar language. This served to elucidate much of the work that was seen both there and later at Svalöf.

The Plant Breeding Station, Svalöf.—Svalöf is probably the feature of Swedish agriculture best known to the world at large; in Great Britain two at least of its products—the " Victory " oat and " Iron " wheat—have spread its fame widely. The Swedish Seed Association began its work on the improvement of farm crops at Svalöf in 1886. Dr. Hjalman Nilsson became Director in 1890 and still holds office. It began with attempts to select the existing varieties of wheat, oats, etc., so as to obtain uniformity and increased yield, by the methods of what we now call " mass selection," such as picking out the largest ears to be found in a field or the best plants in other respects. Thereby little success was obtained beyond a relative uniformity and purity of type. Any old-established variety, say of wheat, even if pure, and commercial varieties even down to recent years were rarely anything like pure, consisting of a mixture of slightly differing strains, all of the same general type but varying in such features as the number of grains the ear will produce, the height and strength of the straw, etc., etc. If one picks out all the long ears some will owe their length to the accident of having obtained a little extra nutriment or water, others—and this will be the smaller number—to some essential quality in their make up which is passed on to the seed arising from them. But in the mixed batch of seed arising from the selection of the long ears, grains will predominate that were derived from ears owing their length to the accident of nutrition and these will not pass on the long-eared character. Consequently the result on sowing will be the reproduction of the original mixed population with relatively few of the true long-eared types, and the improvement of the variety seems as far off as ever.

However, there are real long-eared strains in the mixed population and these can be isolated if instead of sowing the seed from all the long ears together they are grown on as individuals. Then the next year's growth reveals which of them owed their excellence to accident and which to hereditary make up. The best of the latter are saved, again tested as individuals, and eventually a selected one is propagated on a large scale. Thus is initiated a " pure line," the produce of a single individual, which continues to breed true and carries on the superiority which that individual showed to the bulk of the population from which it was derived. This " pure line " mode of selection was introduced at Svalöf about 1893, and it did result in considerable improvement—complete uniformity of crop and increases in the productivity of the order of 5-10 per cent. above that of the old mixed variety. Still it led to nothing new, for new varieties only arise through cross-breeding.

Cross-breeding, however, seemed to result in nothing but confusion and it was not until about 1900 when the bearing of Mendel's discoveries became generally apparent, that plant breeders were put in possession of a method of picking out the fixed races among the innumerable varieties that arise in two or three generations from a hybrid. Now the technique is established in dealing with self-fertilised plants like the cereals; we know that after the cross the characteristics of the two parents will not be merged but reassorted in every possible combination in the progeny of the second and third generation and that some of these combinations will be " fixed " and incapable of further variation. The desirable ones can be picked out and the " fixed " forms isolated, by the method of pure line breeding from individuals. Thus the production of " new " varieties combining the good points of various individuals has been reduced to a system, and this is the method now followed at Svalöf as at other plant breeding institutions.

The plant breeding institution at Svalöf began as a farmers' association and still derives part of its income from subscriptions. Of its present total income of about £20,000, about £11.800 comes from the State and about £5,000 from the Seed Company which sells the new varieties. The Seed Association possesses the buildings required for its work and about 40 acres for its trial plots, together with 8 subsidiary trial stations in other parts of the country. When it has raised a new variety and tested it sufficiently on its small scale, it hands it over to the Swedish Seed Company, the quantity being then perhaps a couple of hundredweight.

The Swedish Seed Company is a separate organisation, with a capital of over a quarter of a million sterling, which carries on the business of propagating and dealing in the products of the Seed Association. Its divisable profits are limited, the surplus being handed over to the Seed Association for the extension of the investigation and breeding work. It possesses farms of about 2,500 acres adjoining the plant breeding station at

Svalöf, and on these farms, as on the subsidiary stations in other parts of the country, the trials of any new variety are conducted after it has been handed over by the Seed Association. The Seed Association still, however, retains control, and the new variety may not be issued for sale until from the trials on a large scale the Seed Association is satisfied of its value.

The effects of the Svalöf organisation upon the character and quality of the crops grown in Sweden can hardly be exaggerated. It has not displaced the private venture seed firm—indeed, at Messrs. Weibuhll's, near Helsingborg, our party visited a commercial firm employing all the most scientific methods for the production of new varieties of farm crops—but it has set a standard throughout the country, and no farmer purchases a new variety unless its performance can be substantiated by the results of rigorous preliminary trials.

The Bondesson Agricultural Company, Svalöf.—It would be tedious to describe the many farms visited, but it is difficult to pass over the Bondesson Agricultural Company at Svalöf. This is a family company farming a little over 900 acres, but owning also a large butter and cheese factory, which handles about 1,700,000 gallons of milk each year. The separated milk and whey are utilised by a famous herd of large white pigs, the foundation stock of which were obtained in England—whence also regular purchases of boars are still made. The herd is maintained in a vast building alongside the dairy. There were at the time 60 breeding sows, and the progeny, so far as they are not sold for breeding purposes, were being fed for bacon. Altogether there were about 1,500 pigs in this range of buildings and the output of bacon pig amounted to about 6 tons per week.

In another building alongside was the dairy herd of about 115 animals in all, 50 cows in milk. It was pure-bred Swedish Friesian and had a high reputation in the show and saleyards. The average milk production was 1,080 gallons, with 3.5 per cent. of butter fat. This of course was a large capitalist undertaking.

A Successful 150-Acre Farm.—Perhaps a more normal farm equally good in its way was that of Mr. Nils Andersson, a member of the Simlinge Bull Society of which mention has been made above. Altogether Mr. Andersson farms about 150 acres of which he owns 130, and on this area he maintains a herd of Swedish Friesians numbering about 70 in all; he also breeds horses and makes a speciality of seed cultivation. This is a notable example of intensive farming.

The National Agricultural Show and the Jubilee Exhibition.—The itinerary concluded with a visit to the National Agricultural Show, which was being held this year—after a long interval caused by the War—at Gothenburg, where also the great Jubilee Exhibition was in progress. Naturally the live stock was of most interest to the British party, which had an opportunity of seeing several breeds of cattle of wide distribution in Sweden but not generally kept in Scania. Among these the most notable was the polled race of white cattle with a few black spots, which is the most numerous race throughout the middle and northern parts of Sweden. It is a neat compact animal, bred and selected for its milk-yielding powers in a rough climate and on poor soils.

The Swedes are great horsemen, and horses figured prominently in the show. Blood horses and hunter type horses were very well exhibited, many examples coming from the State stud farms formed to promote the breeding of remounts. The most characteristic utility horse belonged to the Belgian Ardenne breed, largely used for the improvement of the country race. but very striking were the examples of small active Swedish breed with which two batteries of artillery were horsed.

It needs a better live stock man than the writer to discuss the exhibits, but two points seem noteworthy. There were several classes for bulls exhibited with their progeny. Again, judging was carried on by the score card system, and the cards with all the marks were posted up on the pen of each exhibit. Whatever the merits or demerits of judging by the score card one cannot deny the educational value of the posting up of the score card against each exhibit; the judges' opinions were there set out in detail for all to check and many were the discussions we saw in progress.

Finally, one cannot close without recording the extraordinary kindness and hospitality with which the British party was received. We were entertained by the owners of the great estates we visited day by day, by the Board of the Jubilee Exhibition and by the Board of the Agricultural Show at the dinner they gave in honour of the King. This, however, was little in comparison with the warmth of the welcome we received and the manifest desire of our hosts to make the visit both fruitful and pleasant to us.

RED POLL CATTLE.

R. HARVEY MASON.

IN the Eastern Counties and probably elsewhere there are many poll cattle highly esteemed for grazing and some for milk among the tenant farmers. Many are red, but many more are variable in colour, looking chiefly like shorthorns without horns, though some probably have slugs and may have been with shorthorn or half red bulls.

It was out of this stock that pedigree Red Polls were selected many years ago. The blood-red colour was held in the highest favour, and many farmers in Suffolk and Norfolk were found early in the last century to have herds entirely red and to have been careful to breed from red bulls.

It was Mr. Henry F. Euren, the editor of the *Norfolk Mercury*, who in 1874 with the help of friends who were breeders of Red Polls in Norfolk and Suffolk and were keen about them, published the first volume of the herd book and registered as many Red Polls as he and his friends found up to a standard description. He did this until the Red Poll Society was formed. There were 44 breeders in Norfolk and Suffolk at that time who subscribed to this work, and among them was an ardent American, Mr. G. F. Tabor, of Ravenwood Farm, Patterson County, New York, U.S.A., who afterwards imported a good many of these cattle.

Mr. Euren called the cattle Red Polled, but this name was altered in 1909 by the Red Poll Society which did not admit that any herd ever had horns which had been polled. That society was established in 1888 and purchased the copyright of the books previously published from Mr. Euren.

There is no record of any Red Polls kept in any other counties in Great Britain at the time when pedigrees began, but Mr. Euren discovered that there was an old breed of these cattle in a remote part of Austria and that Prince Terchenstein in 1869 purchased animals from Lord Sondes, who then had a herd at Elmham in Norfolk, to infuse fresh blood into his herd of native bred cattle.

In Arthur Young's survey of Suffolk we find that Red Polls existed there in 1792, and previously to that in "The Suffolk Traveller," John Kirby of Wickham Market refers to the butter they produced being the pleasantest and best in England. Arthur Young found the cattle were spread over the whole county and were sometimes crossed with shorthorns, but he does not recommend this with a view to the dairy. In those days very little if any attempt was made to improve the breed, until the agricultural societies were established and premiums were offered for Suffolk cattle pure bred, *i.e.*, by a Suffolk bull out of a Suffolk polled cow. Whether this plan should be established was discussed at a meeting at which the Earl of Stradbroke presided. It was pointed out that Norfolk also bred Norfolk cows generally called " home breds " and that pure red was its distinctive colour. Although there were polled cattle of various colours both in Norfolk and Suffolk, the Red was always held in best estimation as long ago as 1782. Mr. Marshall, agent of Lord Suffield, Gunton Estate, in the "Rural Survey of Norfolk" says:—

> "The native cattle of Norfolk are a small, hardy, thriving race; fatting as freely, and finishing as highly, at three years old, as cattle in general do at four or five. .... the head, in general, fine, ... the favourite colour, a blood red, with a white or a mottled face .... These two qualifications; namely, the superior quality of their flesh and their fatting freely at an early age .... The medium weight of a well-fatted three year old is forty stone (of fourteen pounds each).
>
> Bulls of the Suffolk polled breed have, ... been brought into this District: and there are several instances of the Norfolk breed being crossed with these bulls. The consequence is, an increase of size, and an improvement of form: but it is much to be feared, that the native hardiness of the Norfolk breed, and their quality of fatting quickly, at an early age, are injured by this innovation ....
>
> The fact appears evidently to be, that the Norfolk husbandmen are in possession of a breed of cattle, admirably adapted to their soil, climature, and system of management: and let them cross with caution;"

The principal breeders in the early part of last century were in Norfolk: Mr. Reeve, of Wighton, Mr. England, of Binham, and Mr. George, of Eaton. These men co-operated to improve the native polled cattle by careful selection, and some of their stock were shown at the Holkham sheep shearing, and attracted much attention. At Mr. Reeve's sale in 1828 the advertisement reads "Eleven matchless blood-red cows in calf, two three-year-old heifers in calf, eleven two-year-old heifers in calf, and a two-year-old blood-red bull, one of the most perfect animals in the Kingdom." Mr. George is said to have bought a cow costing 25 guineas, which at the time was thought to be a very high price. His cattle were sold to go to several places both in Norfolk and Suffolk.

There is no doubt that the establishment of separate classes for Norfolk Poll Cattle at the agricultural shows in that county which were amalgamated into one in 1846, gave great impetus to the improvement of this stock.

Photo] [*Sports and General.*

FIG. 1 —Red Poll Bull, Marham Florin, prize winner at the Royal Show 1923.

Photo] [*Reid, Wishaw.*

FIG. 2 -Red Poll Cow, 18051 Fill P3.

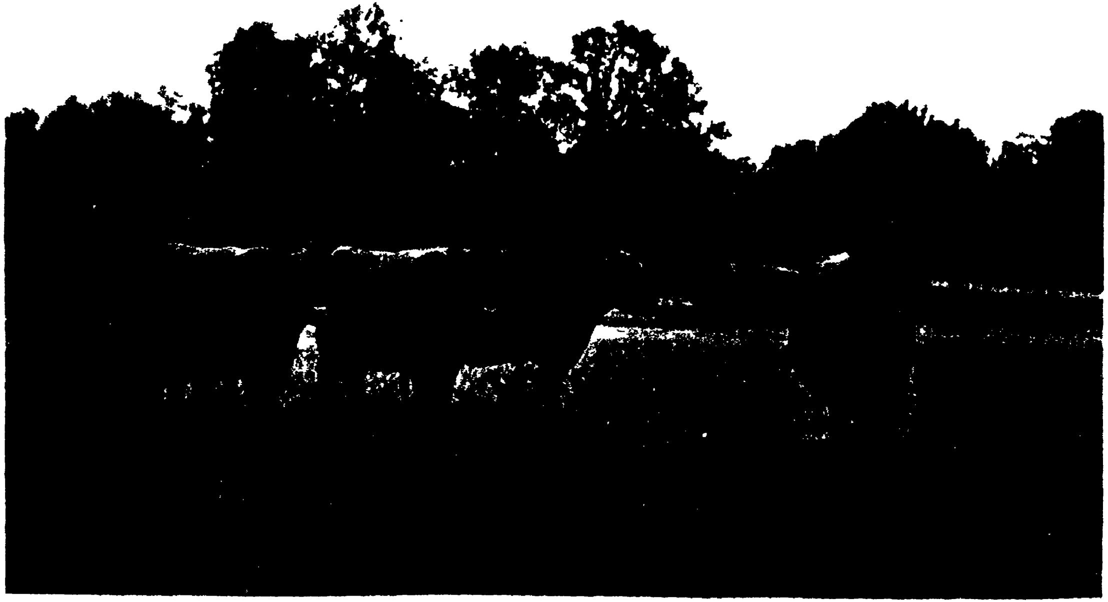

FIG. 3.– Group of Red Poll Cows, owned by Mr. R. Harvey Mason.

At the British Association Meeting at Norwich in 1868 Mr. Clare Sewell Read said:—

> "We have to commemorate a grand revival of the Polled Norfolks as a numerous and distinct breed. The old fashioned gay home breds are not recognised the true stamp of the improved Norfolks, for the latter are a blood-red and while slugs and horns are studiously avoided, and their milking properties well cared for, they possess a uniformity of character, style and make that would do credit to many of our established breeds."

Red Polls are recognised to be a smaller breed than Shorthorns, Friesians, South Devons or Herefords. An average cow's height is 4 ft. 2 in. and girth 6 ft. 6 in. In a grazier's yard 5 can be kept for 4 of the other breeds, some say 4 for 3. They are docile and feed quietly, whereas horned cattle are sometimes troublesome. The beef is of the same value as that of the Aberdeen Angus and cost of feeding is proportionate to the number which can be kept, as quoted above.

A good many Red Polls were exported to the United States from 1882 to 1888 and an American Society was established there. Several of the members were impressed by the value to them of hornless cattle, as horned ones damage horses and other cattle at the drinking places, and as the poll type predominates in cross herds they found a good market for bulls to use for crossing purposes, as the horns disappear.

Milk.—The Red Poll is distinctly a dual purpose animal, producing the best beef and rich milk. The milk yield varies from 5,000 to 12,000 lb. in a year, and owing to milk recording, a good trade for high grade milkers (which at first did not exist), and the breeding from bulls bred from prize-winning cows at dairy shows, milk records are fast improving. The butter fat testings show 3.5 to 4.1 per cent. of butter fat, and even up to 5 per cent. in some cases.

Up to about 1890 the principal trade was for exhibition and export. Americans north and south wanted fine meat and extra good looks, and consequently breeding followed those lines, little attention being paid to milk. This began to alter soon after the Chicago exhibition in which there were prizes for good milkers, and some buyers came over to select a few specially good milking cows which were to give at least 4 per cent. of butter fat. These men showed the farmers how they should buy cows. They went to the early and late milkings and each time brought a Babcock Tester, and tested the milk. This was long before milk recording was carried on as it is now.

Beef.—Red Polls have been always noted for the prime quality of the beef they produce. Graziers have generally obtained 1s. or 2s. a stone more than butchers will give for larger breeds. At the present time there is considerable inquiry for small joints, and Red Poll steers sell well both as stores and finished meat. At a Smithfield Club show weights as follows were recorded :—

				weight		
	years	months	days	cwt.	qr.	lb.
Red Poll Steers under 3 years	1	4	4	11	3	27
	2	10	16	15	2	26
	2	10	18	16	2	23
Heifers under 3 years	2	10	14	15	3	9
Steer „ 2 „	1	10	3	11	3	27
	1	9	8	12		

Description.—The following is the standard description of the breed :—

Characteristics and Form.—

Colour :—Blood-red ; deep red for preference ; tip of tail and udder may be white.

Head :—Must be poll, *i.e.* not artificially polled and without horn, slugs or abortive horns.

Nose :—White.

Hips :—Evenly rounded ; not prominent.

In all other particulars the commonly accepted points of a superior animal to be taken as applying to Red Poll cattle.

Objections.—

Any extension of white in front of the udder.

Any white on a bull except on tip of tail.

A cloudy or dark nose.

Disqualifications.—

Any horns, slugs or abortive horns.

Any signs of artificial polling.

A black or blue nose.

Any white except on the tip of the tail, the udder, or for a short way under the body.

Any colour other than red.

In the first herd book the herds were divided geographically into groups and these groups were subdivided into tribes, certain cows being selected as foundresses of the tribe. This plan has been found very useful for breeders. This book contains only 38 breeders, all from Norfolk and Suffolk. Since that time the members of the society have increased gradually and it now includes 449 spread over a large part of England, Wales and Scotland, and a few in Ireland. Exports have recently gone to

France, Norway, Sweden, South Africa, Rhodesia, Argentina, Brazil, Uruguay, Australia and New Zealand.

The number of registered Red Poll cattle is 5,661, including bulls and cows. Many have passed into the hands of wealthy men. In fact, the value of the herd has been so high that only wealthy buyers have been able to obtain the best animals. Members of the society are still increasing and as there are herds that include very few cattle it may be expected that the future sales will be well attended.

General.—Cattle that have flourished on the poor pastures of East Anglia will go on to much better land, and it may be expected that owing to the careful selections that have been made, to the use of only the best bulls, and to the finer pastures on which they will feed, great improvements in the breed may be expected before long. The best way to improve is to scrap the worst and keep the very best cows and heifers to breed from. The shows and sales promoted by the society will enable breeders to do this. Formerly, until these sales were started, one might wait some time for customers to come along and then naturally they wanted the pick, and if such were continually sold, the herd would go back and require time to recuperate.

In Norfolk and part of Suffolk the pastures are not good as compared with the midlands and west of England. Moreover, the parks are usually well timbered and consequently flies are a great torment to cattle. The larger breeds have seldom obtained any great success in consequence of this in those counties, but Red Polls do quite well. Their habit in warm weather is to feed and also to stand in clumps together, and their tails whisk the flies off one another.

At the agricultural shows Red Polls are increasing in numbers, and their quality is distinctly better than ever. His Majesty the King is patron of the society and is a successful exhibitor, and one may hope that before long he may breed a champion bull and cow.

The colour of a herd of Red Polls is very attractive on the green background of a well wooded park, and if there is any drawback at all it may be that, when they are a well matched breed rather than a collection of various types, it is difficult to distinguish one cow from another except by the ear marks. After all, the herdsmen always know them well and can help the owner out of any mistakes. These men get very proud of the animals of which they have the care, become fairly good judges of them, and can help in the selection of such as are worth exhibiting. They are generally capable of remembering something of the pedigrees and if there is a distinction between sires to use they do not and should not make any mistakes. A good milker can often advise about the udders of cows when there is a difference in the way they milk, and they take readily to the work of recording the weights of milk and entering them on the weekly sheet.

It is advisable to have all one's calves trained to be led and tied up, as it makes them more docile afterwards, and less inclined to get wild when turned out to grass, and finally as heifers come to be served or sent to sales and cows to be tied up for milking. Bulls of course require rather more training to lead than females. Comparatively few males are worth keeping for pure breeding in this country, but in America, Africa, Australia or other countries that have inferior native cattle almost all bulls can be sold at remunerative prices for cross breeding, with the result of immense improvement in the cross breed.

Milk recording has not been carried out long enough for generalisation on particular matters.

Red Poll Cattle Societies in the Colonies and Abroad.—

Australia.—President, the Hon. T. H. Payne, M.I.C., Wordburn, Kilmore, Victoria.
Vice-President, Colonel Arnold Caddy, Chandpara, Tylden R.S.O., Victoria.
New Zealand.—Norman Inder, Secretary, New Zealand Cattle Breeders Association, Kotare, Matatera.
South Africa.—J. Fraser, Secretary, Box 250, Bloemfontein.
Canada.—P. J. Hoffman, Secretary, Aannaheim, Saskatchewan.
United States America.—W. A. Martin, Richland Center, Wisconsin, U.S.A.

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SHEEP SCAB: ITS PREVENTION AND REMEDY.

REPRESENTATIONS have been made to the Ministry during the past year by agricultural bodies representative of a considerable body of opinion amongst sheep owners, in favour of more drastic measures with a view to the eradication of sheep scab. The position of the country with regard to sheep scab is not satisfactory. The number of outbreaks reported by Local Authorities during the past four years is as follows:—

Year	*England*	*Wales*	*Scotland*	*Total*
1919	245	69	124	438
1920	240	107	129	476
1921	368	206	183	757
1922	284	246	153	683
1923 (to 30th June)	158	139	47	344

It will be observed that although there has been a slight improvement since the close of the year 1921, the number of outbreaks still continues large, particularly in Wales and the Highlands of Scotland.

One of the principal difficulties in securing the eradication of scab is the general carelessness and apathy displayed by many sheep owners in carrying out the Sheep Scab Orders and dipping operations, and the reluctance which still apparently exists to accept double dipping (that is, two dippings in a sheep dip approved by the Ministry with an interval of not less than 7 and not more than 14 days between them) as the effective method of preventing and curing scab.

In view of the strong and growing feeling amongst agriculturists throughout the country in favour of a more determined attempt being made to eradicate this disease, the Ministry has, during the past few months, given publicity to a proposal to throw the onus of curing and preventing scab upon each owner of sheep, and has received expressions of opinion in favour of such a policy from many agricultural bodies and Local Authorities.

An Order has accordingly been made which will give effect to this proposal by directly requiring sheep owners to take such steps from time to time as are reasonably practicable to secure that their sheep are free from sheep scab. The Order further provides that occupiers of farms or holdings upon which sheep are kept, and owners of sheep kept on common land, shall be liable in case of failure to take such steps as abovementioned, to the penalties prescribed by the Diseases of Animals Acts, viz., to a fine of £20, or if the offence is in respect of more than four sheep, to a fine of £5 for each animal, or in certain cases, to imprisonment. It is an important provision in the Order that in the case of proceedings instituted thereunder on or after 1st July, 1924, in any case where sheep scab is found, the burden of proving that the Order has been complied with will rest upon the person charged and not upon the prosecutor.

A pamphlet has been issued by the Ministry containing full information as to the measures which it is advisable to take in connection with sheep scab.*

The effective method of curing or preventing sheep scab is double-dipping, that is dipping twice with an interval of not less than 7 and not more than 14 days between the two dippings, provided that the dip used is one that has been approved by the Ministry, and care is taken to see that the dipping is thoroughly carried out in accordance with the instructions on the label. Unless the dipping is properly done scab can never be eradicated.

When dipping to comply with Orders of the Ministry or Regulations of the Local Authority, it is of the utmost importance to remember that:—

(1) The dip used must be one that has been approved by the Ministry. There are a large number of effective dips for scab, non-poisonous as well as poisonous, which have been so approved and the responsibility in selecting an approved dip rests with sheep owners;

(2) The dipping bath must be mixed in the proportions specified as approved by the Ministry. It is inadvisable to make up a dipping bath by mixing two or more dips together, as this may result in neutralising the effect of both dips for scab, and may in some cases be injurious to the sheep;

(3) The directions and precautions indicated by the manufacturer on the label must be strictly observed;

(4) The sheep must be kept immersed in the bath for the period mentioned on the label. Special attention should be paid to the heads, necks, and tails;

(5) During the dipping operations proportionate quantities of dip and water must be added to keep the bath up to the proper strength; it is best to mix these *before* they are added to the bath;

(6) After each lot of sheep has been dipped and before the bath is re-mixed the dipping bath should be carefully cleaned out, the residue being disposed of in such a manner that it cannot injure animals or pollute streams. A satisfactory method is to run the residue from the bath into a trench or pit, the sides and bottom of which have been plentifully sprinkled with lime, so that the liquid from the bath runs through the lime before passing into the soil. This is

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* Copies of the pamphlet can be obtained free of charge from the police or from the offices of the Ministry or the local authority.

specially important when poisonous dips are used in order to avoid risk of injury to sheep through accumulation of poisonous matter. Under no circumstances, however, should the lime be added to the liquid while it is still in the bath;

(7) If an arsenical dip is used for the first dipping it is advisable to use a non-poisonous dip at full strength for the second dipping, but if arsenical dips are used for both dippings, the second dipping should be at half the strength of the first dipping.

Persons using poisonous dips must take the precautions necessary for the avoidance of accidents or injury to sheep through the use of such dips, and the Ministry will not entertain any claim for compensation for injury or loss due to their use. The choice of an approved dip rests entirely with the user. The responsibility for the class of ingredients is a matter for the manufacturer of the dip. The approval of the Ministry only means that the ingredients of a dip are effective for scab in the proportions approved.

The new Order* does not supersede, but is an addition to, the existing Sheep Scab Order of 1920, which prescribes the procedure to be followed in connection with individual outbreaks of sheep scab, and requires all persons having under their charge any sheep affected with, or suspected of, sheep scab, to give notice of the fact immediately to the police.

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CARNATIONS.

H. V. TAYLOR, A.R.C.Sc., B.Sc.,

Deputy-Controller of Horticulture, Ministry of Agriculture and Fisheries.

THE carnation has for many years been grown in large quantities by market gardeners for the sale of the cut blooms. Formerly these were obtained from the classes known as Border Carnations and Malmaisons, which produced blooms in abundance during the summer months only, and though in recent years the season for these has been somewhat lengthened by various cultural methods and a better selection of varieties, they fail to produce blooms over a period sufficient to meet the ever-increasing demand for the carnation. These Border Carnations and Malmaisons, though still cultivated to some extent, have been superseded by the class known as Tree or Perpetual Flowering Carnations. This type or class, when grown under glass, produces practically the whole year round choice blooms with long stems, which keep fresh for extended periods.[*] These flowers are much in demand during all months of the year, and the commercial carnation industry has reached important dimensions.

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* Single copies can be obtained from the Offices of the Ministry, 10 Whitehall Place, S.W.1., free of charge.

This branch of flower growing during the past few years has increased in size and has become highly specialised. More glass-houses are being planted annually to carnations, so that the competition in markets is becoming keener each season, and should markets become overloaded with bloom, only those who are growing carnations exceptionally well are likely to succeed. The industry is not one for the novice to take up. It requires special training to acquire the necessary skill and manipulation, and it is an advantage to have a general experience in growing plants under glass.

Propagation.—The young plants are propagated from cuttings taken from the older plants, and much can be done to ensure healthy plants by taking the cuttings only from plants specially marked either for extra colour in the bloom, for general health and vigour of the plants, or for productiveness. In this way the standard stock of any variety may be retained or may even be improved.

The cuttings are obtained by cutting or pulling off the side shoots from the stems, just below where the blooms are cut, in such a manner that a shoot from 3 to 4 in. is obtained with a heel, though this latter is not absolutely necessary. In making the cutting it may be necessary to remove 2 or 3 pairs of the small leaves, though in the case of longer jointed shoots, it may only be necessary to remove one pair—this to secure a clean stem to insert in the propagating medium. The months from November to February are the best for propagation, though it may be carried out almost at any time provided the right class of cutting can be secured. Carnation cuttings root very freely if given the right conditions.

The cuttings must not be allowed to flag before being inserted in the propagating bed, which is composed of pure sand 2 in. in depth, and made quite firm. It is convenient to have the cuttings at intervals of 2 in. in rows 3 to 4 in. apart according to the size of the cuttings.

After insertion, one good watering in should be given and the lights closed, and if necessary shaded for a few days from strong sun, but rarely is it necessary to shade during the winter months. The pit which contains the propagating bed should be supplied with bottom heat of from 55°-60° F., the higher temperature being the maximum to which it is safe to go. The pit will require occasional ventilation and watering.

In two or three weeks' time the roots will appear, and as these develop, additional air may be admitted stage by stage until the young plants will stand the lights being entirely removed without flagging. The cuttings are now ready for potting and no time should be lost in getting the rooted cuttings planted in pots of size 60 in a fairly good loam made porous by the addition of sand, brick rubbish, or ballast. After this stage the compost should be free working but not too rich.

The pots should be placed on benches or stages in a glass-house kept at about the same temperature and as near as possible the same atmospheric conditions as the propagating house. Light overhead spraying should be given for a few days, and water supplied at the roots when the general condition of the soil seems to warrant it. The temperature of the house meanwhile should not exceed (by fire heat) 50° F. As soon as the young plants have passed the danger from flagging (and this will be as soon as the roots have spread in the fresh soil) air may be admitted. If the atmosphere of the house and general conditions are correct, no shading will be necessary unless propagation has been delayed till quite late in the season. As growth proceeds and the plants develop, more room will be needed and some spacing must be arranged.

Stopping.—It is usual during the early stages of growth and whilst the plants are in 60 pots, to resort to "stopping" to induce the plants to throw out side growths. This is done by removing the growing point down to about the fourth pair of leaves. Some good growers favour the removal only of the appearing flower spike. The former practice gives a bushy plant, but if the latter procedure is practised the side growths appear higher up on the stem. After this "stopping" has been done the plants should grow into sturdy bushy little plants ready for planting out (*a*) into larger pots, or (*b*) into prepared beds in the carnation house.

Re-potting into 48s'.—If the former method of culture in pots is favoured then the plants must be re-potted into 48s' in good loamy soil to which 10 per cent. of well-rotted manure and ½ per cent. of fine bone meal have been added. Generally the young plants should be ready from about the 1st of March onward for transferring into 48s', where they may remain for about two months.

Re-potting into Flowering Pots.—As they become ready they should be finally re-potted into pots of size 24 in soil a little richer than that advised for 48s'. It is an advantage to use soil as coarse as can be conveniently placed between the ball of the plant and the side of the pot without damaging the former. Firm potting is essential. The stem of the plant should not be buried too low, or stem rot may become a source of trouble.

It is the common practice to stand the plants out of doors from about the 1st of June to September, re-housing them just before they come into bloom; but whilst this practice gives economy of labour and housing, it does not produce blooms as fine as those from plants that have been kept under glass and protected from adverse weather conditions. The carnation plants under glass must be given all the air possible and must be watered, not heavily but generously, while on all really hot days the atmosphere of the houses must be kept as cool as possible by frequent damping of the floor, stages, etc. Feeding with manure should not be necessary until well on in the summer.

Planting out in Beds.—Though considerable success may be attained by cultivating and flowering the plants in pots, this method is now very largely superseded by growing the plants in prepared beds of soil in large and well-ventilated glass-houses.

Where beds have to be made up, large quantities of soil are not necessary, 4 to 6 in. of compost being sufficient to carry the plants 2 or 3 years, with an occasional light top dressing of soil and artificial manure.

Good maiden loam enriched with well-rotted manure and some bone meal (say, 1 per cent.) is about the best compost, though it should be of a fairly porous nature, as any tendency towards sourness during the winter months is detrimental This soil should be raised some few inches above the ground by means of bricks, tiles, clinkers, or anything else of a porous nature to provide good drainage and aeration.

The plants from 60s' should be put in beds during April, and treated as advised for pots. If there is likely to be some delay in preparing the beds the plants should be re-potted into 54s' or even into 48s', but there appears to be a distinct advantage to be gained by early planting.

When planting, the ball of soil should be kept as near the surface as possible without actually exposing it, and above all, the planting must be *firm*.

The young plants must be watered carefully until they have their roots well established throughout the whole bulk of soil, when the supply may be more generous. Similar care with ventilation is necessary for the first week or two after planting, but once the young plants have become established, practically full ventilation can be given until September, by which time the flower buds will be showing, the nights will become colder and the atmosphere damper, so that a different line of treatment will be necessary.

With the first cold spell in September, fire heat will be necessary, so as to maintain a fairly dry and buoyant atmosphere. A high temperature is not necessary and must be avoided, so that fire heat can and should be dispensed with whenever possible. In dry weather the temperature can be kept from 46° to 50° F. with just a little fire heat, though on the other hand it may be advisable to fire with the glass outside at, say, 50° F. or even higher to secure the proper atmospheric conditions inside the house.

Disbudding.—Practically all carnations are now sold on single stems, i.e., without any of the secondary buds being left on, so that as the flower stem advances all side buds must be removed; the proper stage to do this is when such buds can be removed readily with the downward movement of one finger, if attempted too early it is quite a tiresome operation and many of the centre buds are liable to be damaged or broken.

Some varieties, such as White Wonder, at certain seasons of the year are apt to give flat or deformed buds, and growers must look out for this. If the disbudding is performed too early it may mean that only the centre and deformed bud is left, but experience should soon teach the grower with which varieties and at what season trouble is likely to occur, and at such times the disbudding should be left till it can be seen that the centre bud is perfect—if not, it must be removed and one of the side buds allowed to develop in its place. On the other hand, in ordinary circumstances disbudding must not be left too long or it will result in the loss of size in the bloom.

Pests.—In common with all other plants the perpetual carnation is subject to various pests, both fungoid and insect, and to keep them as free as possible, all details of cultivation must be carefully observed and carried out at the proper season, but with every care occasional sprayings and fumigations will be necessary to keep the plants clean.

Varieties.—When selecting varieties for market purposes due consideration must be given to the requirements of the particular markets that are to be served.

In the case of sales direct to the consumer or to the smaller florists the choice of varieties is not of such paramount importance, and many more varieties may be grown and sold at a profit in this way than when sending to a large market, which usually wants a bulk of good standard varieties and chiefly self colours, such as Pink, Salmon Pink, Cerise, White, Scarlet, and Crimson, with a very much smaller percentage of Yellow, Mauve and Fancy varieties.

It is impossible to state exactly what are the best varieties to suit all soils and situations: varieties that do well in one soil or locality may not succeed to the same extent in another, possibly only a few miles away, but the following list is a selection of the best in the various colours:—

Pink.
- Mayday
- Mrs. Walter Hemus
- Enchantress Supreme

Scarlet.
- Aviator
- Tarzan
- Beacon
- Edward Allwood

Crimson.
- Triumph
- Carola
- Nigger

Mauve.
- Mikado
- Eastern Maid
- Wivelsfield Claret

Yellow
- Saffron
- Maine Sunshine.

Salmon Pink.
- Lady Northcliffe
- Bona
- Cupid
- Laddie

White.
- White Wonder
- Wivelsfield White
- White Mayday.

Cerise.
- Peerless
- Mrs. C. W. Ward
- Rosette

Fancies.
- Wivelsfield Beauty
- Benora
- Jazz
- Wivelsfield Apricot
- Circe
- Bishton Wonder

Marketing the Bloom.—The flowers should be cut before they are fully developed, and probably the best time to do this is in the early morning. The gathered blooms are taken to the packing shed and placed in deep tins containing clean water. Next comes the process of grading, and this is done by women and girls who sort out the blooms in best and second grades, quickly returning them to the water where they remain till packed for the market. The graded blooms are packed in special wooden boxes, 3 ft. long × 8 to 9 in. broad and 4½ in. deep, lined with tissue paper. The number of blooms packed in each box varies according to the grade and the season of the year—2, 3 or 4 dozen is the usual quantity for the best grades, while the seconds or worst grades are often packed in bunches each of 12 blooms. The blooms are held in position with a cross stick.

A label showing the quantity of blooms and the grade should be attached to the end of the box to enable the salesmen and buyer to judge as to the contents without opening the box, thus facilitating trading and distribution. The blooms are needed for their beauty, and it is important to remember that this may become wholly or partially destroyed through faulty packing.

The writer wishes to acknowledge the generous help and assistance given by Mr. Stevenson of Messrs. Lowe & Shawyer.

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AGRICULTURE AS A CAREER FOR BOYS

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AGRICULTURE as a career offers many attractions. It presents many possibilities and many problems which must be carefully considered before any venture is made. To be successful the farmer must not only be well educated, but also essentially practical, being capable of taking his place in the daily routine of farm work, showing the labourers he can work, and means to do so, and expects them to do likewise. Wide experience, sound judgment, careful training, a good education, and businesslike methods are essential to the modern farmer.

Agriculture opens up a variety of careers. In Great Britain farming may take the form of general farming, or general farming with some specializing in certain breeds of live stock or varieties of crops—or definitely specialized farming, such as dairy farming, pig rearing, fruit and vegetable growing, poultry farming, etc. Abroad, the same general division of the types of farming holds, but the specialized type is of frequent occurrence, *e.g.*: tea planting, cattle rearing, sheep farming, etc. Throughout the Empire there is vast scope. South Africa, Rhodesia, Australia, and New Zealand demand that the prospective farmer shall possess adequate capital. Canada makes no specific stipulation. Representatives of the Dominions will readily supply full information.

For the development and organisation of the manifold activities of such a great industry as agriculture, officials are appointed by the Ministry of Agriculture, and by the county and similar authorities. Research workers are required for the large mass of important research that awaits them at such Experimental Stations as Rothamsted, the Universities, Agricultural Colleges, as well as at private laboratories.

Large and progressive commercial firms, such as "Company Farming" enterprises, seed merchants, firms who make feeding stuffs and artificial manures, textile firms, agricultural engineers, etc., have their staffs of experts, and are generous to really good men who can combine theory with practice in a fruitful way to the elucidation of the many problems that present themselves in this kind of work. Capable men can look to appointments, under Government or otherwise, both at home and abroad.

Finally, there is the demand for able lecturers in Universities, Colleges and Schools.

General Education.—It should be clearly understood that a good general education is just as essential for the boy who proposes to be a farmer as for any other boy, because a broad education will make him a better farmer and a better man. In successful farming a sum equal to 100 per cent. of the capital invested may be turned over in a year. This may mean a turn-over of many thousands, and success demands a man of education at the head of affairs. It also demands a man of real knowledge. which is not merely book knowledge, but practical experience, coupled with scientific training. There is no substitute for practical experience. School and college may prepare the way for more enlightened, more progressive, more successful work, by the farmer or by the agricultural scientist, but to each of them practical experience is essential, and this experience is not obtainable except "by the sweat of the brow." Unfortunately, this fact is frequently misinterpreted as a reason for neglecting the general education, for the premature withdrawal of a boy from school, or for specializing in agricultural subjects at too early an age.

It is agreed then, that the boy must be well educated. At school he should certainly learn science, with engineering and woodwork if possible. During his school days—say till 16 to 18 years of age—the future agriculturist should have been spending much of his holidays on farms. If the boy has been at a school where agriculture has been well taught, he is now in a position to make a start in life by commencing as a farm pupil. But such schools are not common, so the boy should, in most cases, go to a Farm Institute or an Agricultural College, or the Agricultural Department of a University for a sound course of instruction. If the boy intends to do this, he should arrange to pass any necessary examination before leaving school, and at such a time as will enable him first of all to spend at least twelve months working on a farm.

Agricultural Education.—No one doubts the value of agricultural education. It enables the agriculturist to move with the times, it broadens his views, and it provides that valuable knowledge of the fundamental principles upon which agriculture rests. There is too much loss occasioned by the time-lag between the liberation of new knowledge and its application. There is too much hesitation in trying new ideas, and too little ability to profit by the object lessons provided by others. Agricultural education prepares the way for progress. The scientific man opens the book of knowledge. It is for the farmer to read and to learn and to profit the world and himself by the knowledge. A scheme of education that provides nothing better than " half-baked scientist farmers " is not agricultural education, nor does it advance the cause of agriculture.

There is no lack of opportunity of obtaining agricultural education throughout the country, and for convenience of description, the types of agricultural education available will be described under four headings: (1) College or University, (2) Farm Institutes, (3) Local Courses, (4) Schools with Agricultural Departments.

1. *College or University.*—Gives a course of 2, 3 or 4 years to men who intend to become landowners, occupiers or managers of large farms, land agents, lecturers, officials, etc.

The colleges demand a sound preliminary general and scientific education.

For details, apply to the Ministry for a copy of Leaflet No. 197.

2. *The Farm Institute.*—This is intended for the instruction of sons of smaller farmers, bailiffs, etc., who cannot leave the farm for the whole of the year, but can take short courses of instruction in the winter months. The course provides fundamental technical instruction, which will put those following the

course in touch with modern methods of farming. It also enables them to take advantage of information and advice provided by the Ministry, by books, and by the technical press. For details apply to the Ministry for Form 782/T.E. and Leaflet No. 197.

3. *Local Courses.*—These aim at bringing instruction to workers on the land by means of evening or day classes, lectures, demonstrations, or manual instruction-classes in the various skilled operations of the farm. Courses in agriculture, dairying, veterinary hygiene, horticulture, fruit growing, poultry keeping, instruction in agricultural processes (hedging, ditching, ploughing, etc.) are usually provided free or at a nominal charge by County Agricultural Committees or similar Local Authorities. Details are obtainable on application to the Agricultural Organiser or to the Secretary, at the Office of the County Council.

4. *Schools with Agricultural Departments.*—There are a few Schools in the country which, besides giving a good general education, provide for considerable specialization in agricultural subjects. These schools vary in character, and more exact information may be obtained by application to the Headmaster or Principal of the school or to the Board of Education.

The following schools specialise, more or less, in agricultural subjects:—

1. Dauntsey Agricultural School, West Lavington, Wiltshire.
2. Sexey's School, Blackford, Wedmore, Somerset.
3. Brewood Grammar School, Staffordshire.
4. North Eastern County School, Barnard Castle, Durham.

Free Agricultural Education—Scholarship Scheme.—Exceptional opportunities are provided for boys and girls who intend to take up an agricultural or allied pursuit. Scholarships are offered by the majority of County Councils, which enable suitable students to attend courses at University Departments of Agriculture, Agricultural Colleges and Farm Institutes. These scholarships are awarded to residents in the respective counties, and particulars may be obtained by application to the County Council concerned.

Scholarships are also offered by the Ministry of Agriculture and Fisheries, but the beneficiaries under this scheme are limited to the sons and daughters of agricultural and rural workers. The scholarships are of three types:—*Class I* scholarships enable students to attend degree and post-graduate diploma courses at Agricultural Departments of Universities, or, in the case of veterinary science, at the Royal Veterinary College, London;

Class II scholarships enable students to attend a two-years' course in agriculture, dairying, horticulture, or poultry-keeping, at University Departments of Agriculture and Agricultural Colleges; *Class III* scholarships enable students to attend courses of one year's duration or less in agriculture, horticulture, poultry-keeping or dairying. and are tenable, for the most part, at Farm Institutes. Under the scheme, 10 scholarships each of Classes I and II and from 100 to 150 of Class III may be awarded by the Ministry each year. Further particulars can be obtained on application to the Ministry.

Practical Training and Experience.—No one should think of starting to farm on his own account until he has had practical experience for at least two or three years after leaving school or college. He must learn not only to plough, harrow, mow, reap, hedge and ditch, and perform every other agricultural operation or process, but also to determine just when these operations will achieve the best results. He must learn to manage the live stock of a farm. In all probability this experience is best obtained on a good mixed farm—not too large—where he works as a farm labourer would, and where he gives a hand with everything. After this stage a knowledge of farm managing and marketing is needed, and for this purpose, he should try to go as a pupil on a rather larger farm, under a sound practical man who is willing to take the pupil about with him round the farm, and to market, and explain his methods. It must be remembered, too, that only a few of those farmers whose characters, abilities and business methods are outstanding, have either the inclination or capacity to impart the knowledge they possess. The selection, by the parent, of the farmer who will guide the boy is all-important, and in this matter the County Agricultural Organiser may be in a position to offer valuable advice. Big premiums do not necessarily buy valuable experience, though it can seldom be obtained without being well paid for.

Finally, before starting to farm, the future farmer should endeavour to obtain experience for at least two years, in a responsible position, in the actual kind of farming he proposes to take up, and preferably in the part of the country where he is going to farm. Soil. climate, markets, local practices, etc., vary a great deal, and the knowledge of the relation between these factors and the mode of farming is essential before success can be achieved. The premiums required by farmers and others to take pupils also vary. In a few cases a farmer is willing to take a pupil, more or less as a return for the work done by him, but as a rule the farmer requires an adequate premium, and also demands that the pupil shall be a worker, and mean business. A pupil who finds his own lodgings may have to pay any sum from £50 to £150 per annum, the amount varying, of course, with the circumstances of the pupilage. If the pupil lives in the farmer's house, the amount may vary from £100 to £250. It should be remembered, however, that this apprenticeship is a most important part of the boy's training, and that the thing that really matters is for the boy to receive the sound preparation so vital to the success of his future career.

Prospects: Capital.—It must be set down at the outset that, at the time of writing, the prospects of farming are none too rosy, and that the question of capital is all-important.

A farmer who knows his business, and is not unduly hampered by lack of capital or unfavourable conditions, will be able to make a living, provided that he is prepared to work hard for long hours, practically every day of the year. There are light and heavy seasons, but if he is of the right sort, he will get his recreation out of his farming. If, however, he is so constituted as to require a comparatively high standard of living and leisure apart from his farm, he had better take up some other occupation.

It is quite impossible to speak with certainty on the prospects of farming, or to give any definite figures as to the capital required. So much depends upon the fluctuating conditions of the day and on the personal factor. Agriculture is passing through a difficult period, and what the future holds nobody can say.

Some parents who are considering farming as a career for their sons are fully aware of every aspect of the financial side of the business, but there are others who do not possess this knowledge, and for their benefit the following generalisation and figures are presented, which, however, must be read with all caution and accepted as a rough guide for the present time only.

Small farms are severely handicapped by high capitalisations and heavy expenditure, particularly in rent, rates and labour, together with certain difficulties in marketing.

In the last year or so profits have been made on farms which are almost entirely grass and have maintained dairy rather than grazing herds. Those that are half arable and half grass have little more than held their own, while heavy losses were, in many cases, made on arable farms. These results have been largely affected by the drop in values, which has occurred during the last two years. (In 1922 it may be specially noted that not only was the price of corn poor, but the yield also.) However, labour and commodities which the farmer has to buy are becoming cheaper—facts which help to counteract the effect of low prices.

The capital required to take a farm is about £15 an acre for ordinary farming, or, calculated on a different basis, the capital required is at least ten times the rent for ordinary farming, and more for specialized farming. In a few instances, as in the case of large farms and chalk farms, the figures may be somewhat less than those given above, but generally speaking, it will be dangerous not to assume these figures as the minima. The capital required will vary to a very appreciable extent with the locality, the type of farming, and other circumstances. The fact that there must be ample capital at the back of the prospective farmer cannot be too strongly emphasised—to start farming with insufficient capital is to court failure.

There is little to be gained by training a boy without access to capital, for large scale farming. There are as yet comparatively few openings in Great Britain, for a clever boy without money to get a footing in the business of farming by beginning in a lowly paid post, and developing into a manager. Such a boy may possibly become an official or expert, but he stands little chance of becoming a farmer on his own. However, he can go abroad into the colonies and do well.

Starting the Career.—In choosing a farm, and in dealing with the difficulties which will inevitably arise when he starts on his own, a young farmer should obtain, if possible, the advice of a really good, trustworthy, practical farmer in the district. The struggle will be his own, and he must face it, but good advice should always be sought and followed when it is available.

The candidate for research, organizing, teaching, and expert posts, may be safely left in the hands of University and College Authorities. The good, keen man will always be noted.

Branches of Practical Agriculture other than Farming.—There are several careers nearly allied to that of farming, in which a livelihood can be obtained from the land, such as market gardening, fruit and flower growing, nursery gardening, etc. As in the case of farming, knowledge, experience, energy, business capacity, and other qualities are essential to success, and special consideration must be given to markets, situation, soil, climate, labour, and other factors, before a holding is decided upon. The capital outlay is very variable, and it must be remembered that in the specialized industries mentioned the capital required per acre tends to be higher—however, the acreage required is often relatively small. It is well known that many have found in this kind of work a congenial and remunerative mode of life.

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SAINFOIN.

SAINFOIN (*Onobrychis sativa*) is a leguminous forage plant, which is believed to be truly indigenous on chalk and limestone soils in the South and South-east of England. The common cultivated variety is said to have been introduced from France about the middle of the 17th century.

The plant has pinnate leaves and racemes of pink flowers on long stalks. The fruit is a single-seeded pod, easily recognised by the net-veined markings on the surface. The seed is bean-shaped and about three times as large as red clover seed.

Varieties and Their Uses.—There are two varieties in commerce, viz.: (1) Common Sainfoin, (2) Giant Sainfoin.

Common Sainfoin is a slightly smaller and much longer-lived plant than the giant variety, and is often used in temporary and permanent pasture mixtures on soils which are fairly rich in lime.

As a rotation crop, common sainfoin may be cut for hay and the aftermath grazed for sheep. As a sheep food the young herbage of sainfoin compares very favourably with that of any other forage crop. more especially for finishing off sheep for market.

It generally attains a height of about two feet and flowers normally in late May or during June. Common sainfoin is usually at its best about the third year; but under suitable conditions it may be allowed to stand for 5, 7 or even 10 years.

Giant Sainfoin was introduced from France, and there are records of its being grown near Baldock (Herts) as early as 1832. It is shorter lived and more luxuriant in growth than common sainfoin and can give two cuts of hay during the year; hence it is suitable for rotation cropping. It is not usually

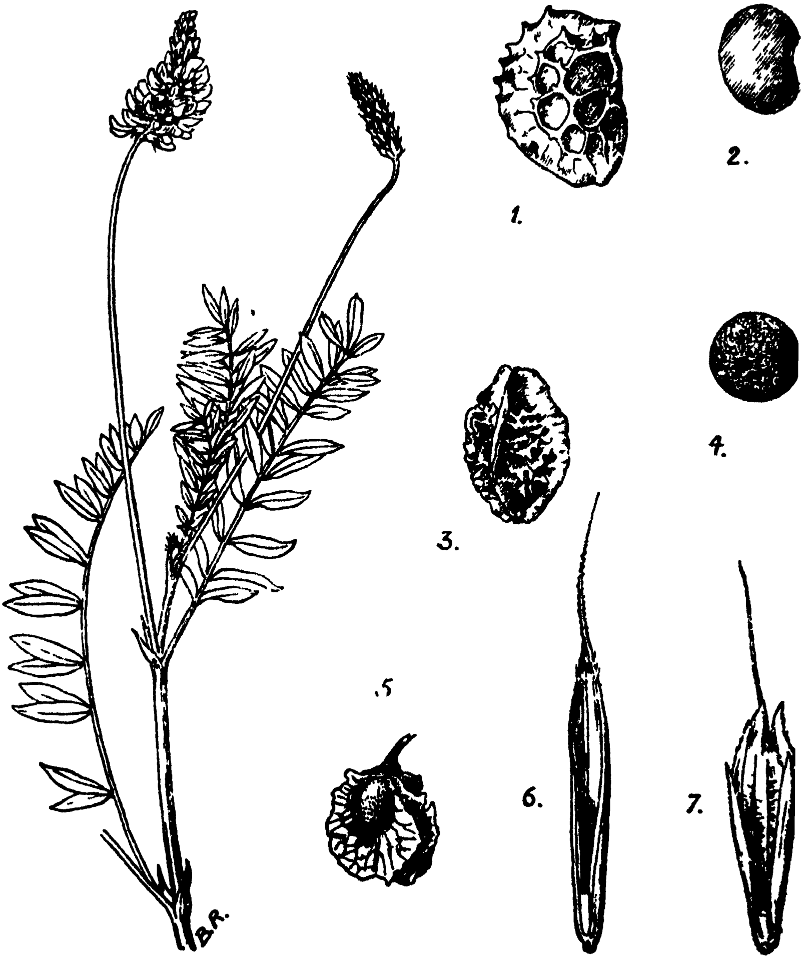

Plate I.—SAINFOIN (*Onobrychis sativa*, Lam.).

Seeds in Sainfoin Samples, all × 3.

1. Sainfoin, unmilled.
2. ,, milled.
3. Burnet (*Poterium Sanguisorba*, Linn.).
4. Cleavers (hooks rubbed off) (*Galium Aparine*, Linn.).
5. Dock sp. (*Rumex* sp.).
6. Barren Brome (*Bromus sterilis*, Linn.).
7. Field Brome (*Bromus arvensis*, Linn.).

left down for more than two seasons. It is a useful alternative crop to clover on those soils in the south and south-eastern counties of England where it can be grown successfully.*

Soil and Climate.—Although sainfoin seems to prefer light soils containing a considerable percentage of lime, it is adaptable to a much wider range of conditions than is generally believed to be the case. Good crops are grown both on clays and loams in districts where the climate is dry and warm. Under suitable conditions the primary root descends to a great depth, and the plant is able to withstand the severest drought, being almost independent of surface moisture. Stagnant water, however, is fatal to the success of the crop. On the poorer and lighter classes of soil, sainfoin contributes very materially to the success of subsequent crops. Barley, for instance, follows it with great advantage and on thin, dry soils unsuitable for turnips, rape and mustard may often be successfully grown after sainfoin.

Preparing the Seed-Bed.—The cultural conditions best suited to the growth of sainfoin are practically the same as for lucerne.† The soil should be clean and in good heart, the sub-soil well-drained and readily penetrable by the tap-root.

Seed and Method of Sowing.—The seed of commerce may be obtained in the husk (unmilled) or with the husk removed (milled). The use for seed purposes of milled sainfoin has advantages over the use of sainfoin in husk. In some districts there may be a prejudice against the use of milled seed, the opinion being held that stocks of the old common sainfoin are more likely to be genuine if obtained in the husk. There does not, however, nowadays appear to be any grounds for this belief. Evidence that has accumulated at the Official Seed Testing Station shows that higher purity and germination will usually be obtained from milled than unmilled seed.

The purity of sainfoin in husk is on the average one or two per cent. lower than that of milled seed. Moreover, the nature of the impurity is different. It is difficult entirely to eliminate brome grass, burnet or similar large seeds from unmilled sainfoin, whereas the impurity in the milled seed consists usually of broken fragments of seed.

Unmilled sainfoin always contains a small proportion of husks which are either entirely empty or which contain partially developed seeds. These would be eliminated by milling. Also a healthy seed may have great difficulty in breaking through the husk and may die in the process. It will be clear, therefore, that, other things being equal, a milled sample of seed will have a higher germination than the same sample in husk.

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* Sainfoin is believed not to be susceptible to Stem Eelworm. It is susceptible, especially the first year. to Clover Stem Rot, and occasionally is attacked severely. *See* Leaflets No. 46, *Stem Eelworm*, and No. 271, *Clover Stem Rot.*

† *See* Leaflet No. 160, *The Cultivation of Lucerne.*

The milled seed has a smooth surface, is kidney-shaped, and in good samples is plump and yellowish-grey or light brown in colour outside and of a greenish tint inside. When black or shrivelled it has been spoilt either by bad harvesting or old age, and perhaps by a combination of both. Only fresh coloured seed should be sown and all old or discoloured seed discarded.*

The seed is drilled in 7 in. to 12 in. rows, at right angles to the corn or other cover crop from February to May a little deeper than clover seed. The land should be in good heart and for this reason is often in corn after a root crop fed off with sheep. The corn crop should be sown thinly (about 1½ bushels per acre) with a corn drill, and in spring-sown corn the sainfoin may be sown immediately after with the same corn drill. In this case the drills will be approximately 7 in. wide, with the result that subsequent intercultivation will not be quite so easy as with a slightly wider drill. When the corn or cover crop has been sown in the autumn, there might be more difficulty in getting a sufficiently good tilth in spring for the sainfoin, and in such cases it is often advisable to use a disc drill, so as to get the seed in sufficiently deep to be properly covered. In the case of common sainfoin, which is intended to occupy the ground for a number of years, the soil should be free from weeds and it may even be advisable in some cases to sow this variety without a covering crop. Four bushels of unmilled seed or 56 lb. of milled seed per acre is the customary rate of sowing. It is usual to grow sainfoin pure in the Eastern Counties, but on chalk or limestone in the South and West of England it is often used as a constituent of a mixture for temporary or permanent leys. A mixture of giant sainfoin, red clover and Italian rye grass makes excellent hay.

Manuring.—When practicable a dressing of very short dung, *i.e.*, thoroughly rotted to destroy weeds, given during the first autumn, helps the plant in the early stages, and is, moreover, a protection against frost. This should be followed in the spring with a dressing of 2 to 3 cwt. of superphosphate and 2 to 3 cwt. of kainit per acre.

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* As regards the provisions of the Seeds Act, 1920, and the Seeds Regulations, 1920, and also as to the facilities offered to farmers by the Official Seed Testing Station, Huntingdon Road, Cambridge, *see* Form No. 728/C.S., obtainable from the Ministry.

If the sainfoin continues to be cut for hay the above dressing of superphosphate and kainit should, generally speaking, be continued each year, although a further dressing of farmyard manure would be useful after an interval of three or four years.

Cutting the Crop for Hay.—*It is important that cutting for hay should start directly flowering commences*, as the plant is then at its best for feeding purposes, and each day's delay impairs both the quality of the hay and the future yield of the plant. It should be handled with great care, like lucerne and clover, to avoid breaking off the fine leaf; but it is not readily spoiled, if left unturned, even in wet weather. A yield of 30 to 40 cwt. of hay per acre is considered an average crop. In the case of giant sainfoin two crops of hay are often mown the first year after sowing, while seed is generally taken from the second crop in the second year, before ploughing up. Common sainfoin is usually cut for seed in its last year, before ploughing up, but a seed crop may be taken in any year except the year after sowing. When allowed to ripen for seed, cutting takes place in July or August, as soon as the lower seeds are fully ripe, and the crop is carefully dried before being stacked. In order to prevent shedding of mature seed, it is desirable to cut the seed crop either early in the morning or late in the afternoon, when the plants are not too dry. In a good season 25 to 30 bushels of seed in the husk may be obtained per acre.

If it be intended to keep the crop down for several years, it is usual to cut sainfoin for hay in the first year in order to encourage deep rooting; afterwards it may be mown or grazed as circumstances require. Whether as hay or as green forage it is an admirable food for all fattening and breeding stock, and is regarded as the best possible change for stock which may not be thriving on ordinary pastures.

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THREE NEW DISEASES OF THE HOP.

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IN the following article, three fungous diseases of the hop, new to this country, are described. The first disease, the "Downy Mildew," is an introduction from Japan or from America, and its potentiality as a dangerous disease may be gauged from the fact that the fungus is included amongst those legislated against in the " Destructive Insects and Pests Order of 1922." The second disease, the " Leaf-spot," causes a " spotting " of the hop-leaf, and has, so far, not been observed to cause any serious injury; the fungus concerned was found to be a species of *Cercospora* new to science. The third disease, to which the name " Hop-drop " has been given, is associated with the presence of a minute fungus (*Macrosporium*) which attacks the stalk of the cone, " eating " it through and causing the cone to fall to the ground.

1. **Downy Mildew** (*Pseudoperonospora Humuli* (Miyabe and Takah.) Wils.).—In October, 1920, when examining, in the experimental hop-garden at Wye College, a number of seedling hops raised from seed of the " wild hop " (*Humulus Lupulus* L.) obtained from Italy, we noticed that on some of the plants the leaves were spotted in an unusual manner, the characteristic feature of the spots being their angular outline. The spots were dark brown above and paler on the under-surface of the leaf. When the lower surface of the leaf was examined with a lens, a blackish-grey " mould " was visible on the discoloured areas, and under the microscope the " mould " revealed itself as composed of the branched fructifications of a " Downy Mildew " (*Peronosporaceae*). At the tip of the branches fruit-bodies (*sporangia*) were borne; each of these, placed in a drop of water, produced in the course of 2 or 3 hours a number of actively motile *spores* (*zoospores*) which swam about in the water until finally they settled down and began to germinate by putting out a short germ-tube. When this took place on a hop-leaf, the germ-tube entered the leaf, formed a *mycelium* within it, and gave rise after a few days to the fruiting-stage of the fungus.

Although a search was made for the fungus on the same plants and elsewhere in the experimental hop-garden in 1921 (a very dry season), it could not be found, but early in September, 1922 (a very wet season), it reappeared, both on the leaves of a considerable number of seedling hop-plants of various origin, and on the hop-cones of several of the plants. On the leaf the disease was again characterised by the angular outline of the spots (*Fig.* 1). On the hop-cone, the bracteoles were attacked first, and this gave the hops in many cases a striped appearance, the vertical rows of dark brown bracteoles (which withered under the attack) alternating with the bracts which were still green (*Fig.* 2). Later in the same year (October) another form of fructification of the fungus was found, viz., resting spores *(oospores)*—rounded bodies, thick-walled and measuring 28-34 μ in diam.—formed by the spawn (*mycelium*) of the fungus in the substance of the leaves just below the lower epidermis. These resting-spores falling to the ground with the leaves would remain alive until the following season and germinating then, would thus perpetuate the disease from year to year.

When the disease was found again in 1922, and both forms of its fructification obtained, it was suspected to be the species of "Downy Mildew" described in 1905 as occurring on the hop in Japan, and named *Peronoplasmopara Humuli* by Miyabe and Takahashi.* This supposition was found to be correct when, later, we were able to examine authentic specimens of the fungus from Japan sent to us by Prof. Kingo Miyabe.

Since the present disease is one of which hopgrowers in this country have had no experience, it will be of interest to give here an account of the disease as it has been observed in other countries. The following extract* relates to its original discovery in Japan: "It was in the early summer of 1905 that our attention was first drawn to a diseased appearance of the leaves of the cultivated hop-vines in the experimental plot of the Hokkaido Agricultural Experiment Station in Sapporo. An examination showed at once that it was due to a kind of 'downy mildew.' . . . In the hop-field belonging to the Sapporo Brewery Company a careful search was made on June 15 this year (1905), and we found the mildew to have already begun to spread to an alarming extent throughout the field. A portion of the field adjoining the place where the hop-vines were collected and burnt the previous autumn was very badly attacked. The lower leaves of the vine [bine] were at that time most infected, but the disease had already spread to some of the upper leaves. Judging from the extent to which the fungus had spread in the field, we may safely infer that the disease had existed there for many years without drawing attention. Messrs. S. Fujita and J. Kasaharae, of the Company, struck with the seriousness of the case at once took active measures to combat the disease. By thoroughly spraying with Bordeaux mixture and by systematic picking of the affected leaves, they were able to prevent the spread of the disease for the rest of the year."

The fungus has been found also in Japan on the wild hop, *Humulus Lupulus* var. *cordifolius*, indigenous to that country, and Prof. K. Miyabe remarks (*l.c.*): "These facts prove beyond

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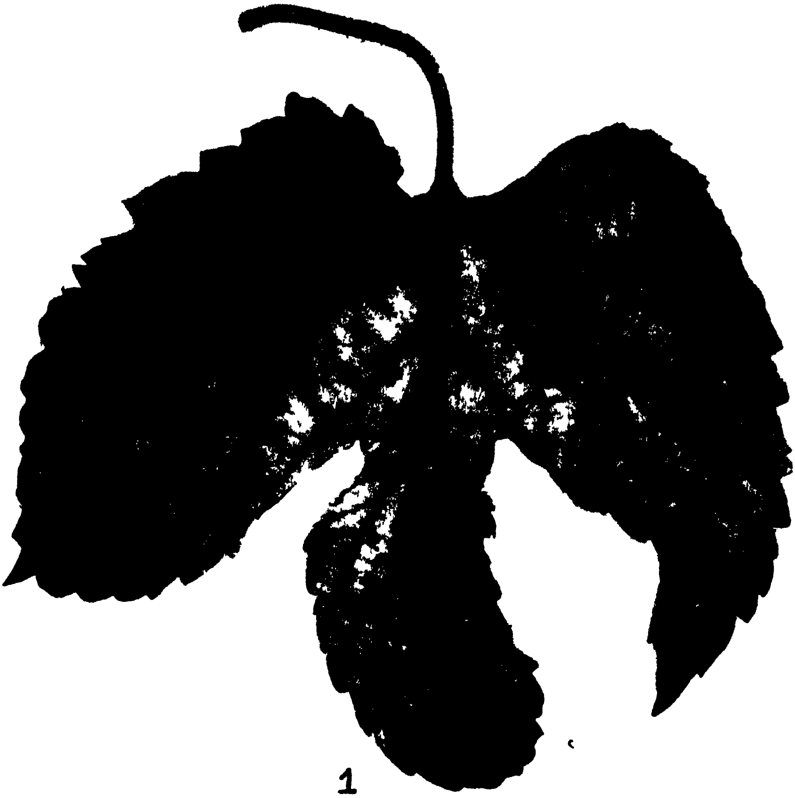
* *K. Miyabe* and *Y. Takahashi;* in *Trans. Sapporo Nat. Hist. Soc.*, I, part 2, (1905–6).



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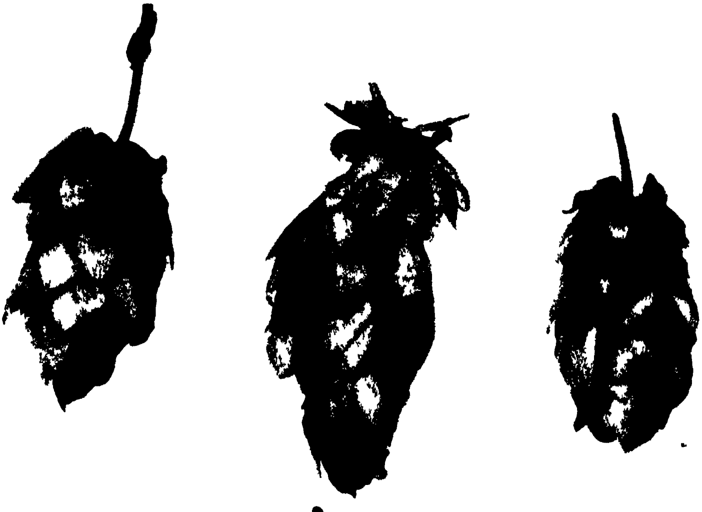

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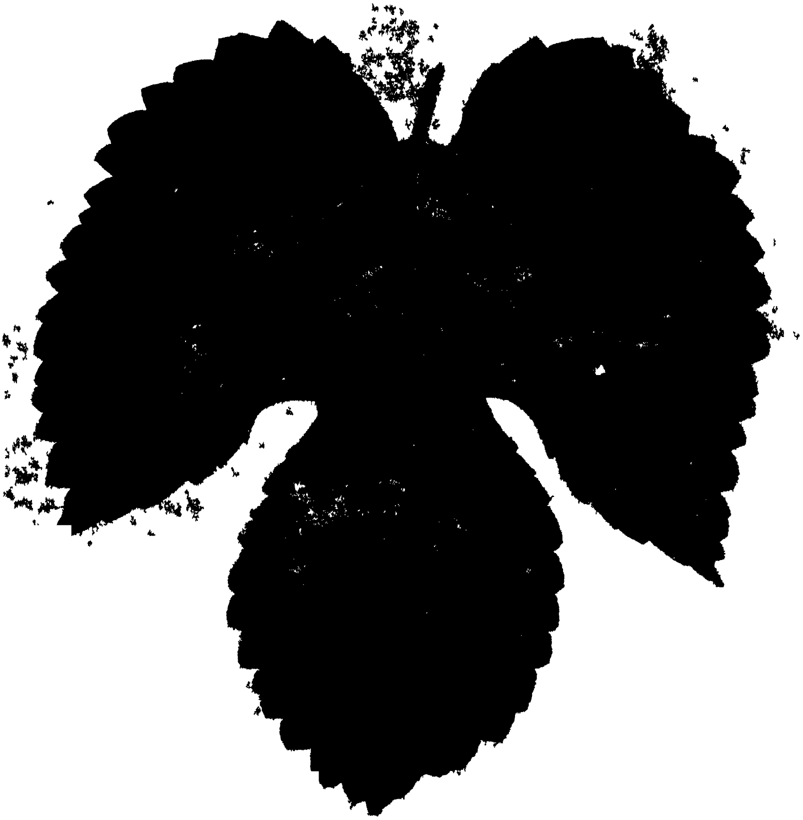
FIG. 1.—Hop Leaf showing the Angular Spots caused by the Downy Mildew (*Pseudoperonospora Humuli*) (Nat. size).

FIG. 2.—Hop-cones attacked by Downy Mildew; the bracteoles are attacked before the bracts, so that the discoloration often appears in vertical stripes as seen in the middle cone (Nat. size).



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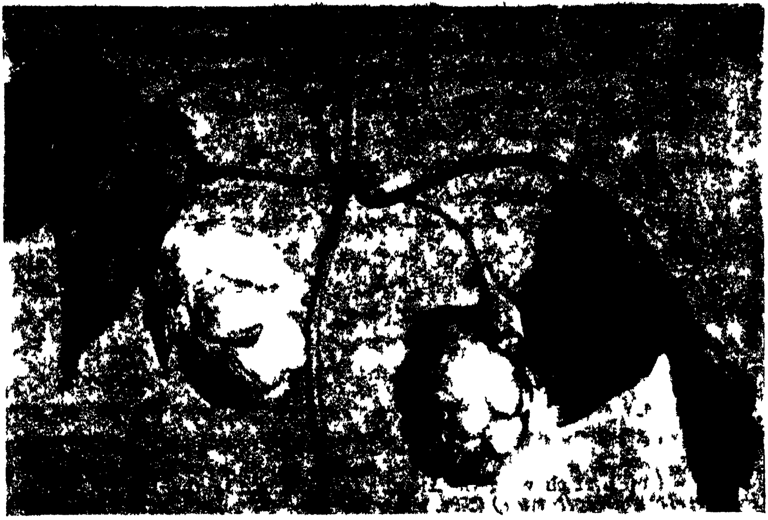

FIG 3 Hop leaf attacked by the 'Leaf-spot' disease caused by *Cercospora cantuariensis* (Nat. size)

FIG 4 —Hop cones showing the stage in the 'Hop drop" disease when a brown, discoloured mark is seen near the middle of the stalk, later the hops become detached at that point and fall (Nat size)

doubt that the mildew is indigenous to this country growing on the wild hop-vine, and has recently found a more congenial host in the cultivated hop-vines introduced from America and Europe."

In a letter received recently from Prof. Miyabe, the following additional information is given: " The mildew attacks the cones of the cultivated hop, making them quite worthless. I have found the fungus on *Humulus japonicus* too."

In 1909 a " downy mildew " was observed* by Dr. J. J. Davis on the " wild hop," in the State of Wisconsin, in North America. In a letter sent to us in 1921, Dr. Davis writes that he met with the fungus (which he has identified as the same species (*Pseudoperonospora Humuli*) described from Japan) again in the previous summer in the north-eastern part of the State, and adds: " I do not doubt that it is indigenous."

The manner of introduction of the " downy mildew " of the hop into this country is unknown. Roots and seeds of the wild hop of Japan (*H. Lupulus* var. *cordifolius*) were obtained in 1917 from Japan and planted in the experimental hop garden at Wye College, but the " downy mildew " carefully searched for each season since 1920, has never been found on plants of this origin. If the fungus is indigenous to the United States, as has been asserted, there exists the possibility that the downy mildew has been introduced into this country on hop plants obtained from America.

There is also the possibility that the garden plant, *Humulus japonicus*, which is grown not infrequently in England as an ornamental climbing plant, has been the means of introducing the fungus on imported seeds.

It is much to be feared that in wet seasons the " downy mildew " of the hop may prove a dangerous enemy. On the first appearance of it on the hop plant, the affected leaves should be picked off *and taken away from the hop garden and burned;* the whole plant should then be well sprayed with Bordeaux mixture.

Any outbreak of the " downy mildew " of the hop should be at once reported to the Ministry of Agriculture.

2. **Hop Leaf-Spot.**—A disease, in the form of spots or blotches on the leaves, was noticed in September, 1922, in a

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* Dr. J. J. Davis, "A New Hop Mildew" (*Science*, n.s., Vol. XXXI, 752 (1910)).

hop-garden, of the Canterbury Golding variety, near Canterbury. The spot caused by the disease was circular in general outline (*Fig.* 3), with a greyish (almost white) central portion, $\frac{1}{20}$ to $\frac{1}{8}$ in. diameter, bordered by a dark, purplish-brown line, outside which was a yellowish zone which gradually merged into the general green of the healthy parts. Where the spots were close together on the leaf the yellow zones coalesced to form large yellow areas. These colour characters were more conspicuous on the upper surface of the leaf than on the lower. With a pocket magnifying glass hair-like outgrowths were visible projecting from the lower surface of the spots. Under the microscope these were found to be the *spores* of a fungus belonging to the genus *Cercospora**; each spore was cylindrical, with tapering ends, pale brown in colour and divided by cross-walls into a variable number (5 to 14) of cells. The size of the *spore* is variable; the length is usually 200μ or more, and the width about 14μ.

Although no appreciable damage was observed to be caused to the hop plants on which this disease occurred, it appears desirable to record this new enemy of the hop, as other species of *Cercospora* are capable of causing very serious injury to the plants on which they occur.

3. **Hop-Drop.**—A disease, for which the name "hop-drop" is proposed, was met with in September, 1922, in a hop-garden near Canterbury. The disease manifested itself by causing a considerable number of the hop-cones to fall to the ground shortly before the hops in the gardens concerned were ready for picking. The varieties of hops affected were Cobbs and Canterbury Golding. An examination of the hop-plants showed some of the cones hanging loosely on brown stalks ready to fall, and others with various amounts of browning on the stalks, the first stage of the disease being evident as a brown discoloration on the stalk at about half an inch below the hop (*Fig.* 4).

A fungus was invariably present on the brown portions, bearing *spores* on short stalks; these *spores* were broad and rounded below, and narrowed towards the apex, pale brown in colour and divided into a number of cells by several transverse walls and usually also by a few longitudinal walls; they measured 23-67 × 10-15μ.

The constant association of the fungus (*Macrosporium* sp.) with the brown discoloration on the stalks suggests that it is the cause of the trouble, but confirmation by inoculation experiments has not yet been possible. It seems probable that this fungus belongs to that class of parasites which are able to attack plants only when the latter are in a state of "physiological weakness," a condition likely to have been produced in the hop-plants in question by the cold and wet weather, accompanied by gales of wind, that occurred during early September last year.

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*The species proved to be new to Science, and has been named by us *Cercospora cantuariensis* (see *Journal of Botany*, Vol. 61, 134 (1923)).

Although in the above case the quantity of hop-cones which fell to the ground before picking-time and were lost was inconsiderable, the disquieting effect on the mind of the farmer was considerable on seeing a portion of a crop on which several hundreds of pounds had been spent, falling to the ground and being wasted.

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PERMANENT ALLOTMENTS: "SECURITY OF TENURE" AND HOW TO OBTAIN IT.

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General Secretary, Addiscombe and Woodside Allotments Society (1921) Ltd., Croydon.

THE one thing which is uppermost in the mind of most allotment holders is security of tenure. It is difficult to see how any allotment holder can be expected to produce the best possible results of which he may justly feel proud if he has the constant fear in his mind that one day, either now or in the near or distant future, his land will be taken from him for building or other purposes. This fear must be prejudicial to the cultivation of an allotment, and in this connection it should be remembered that an allotment provides a man with a form of recreation and undoubtedly tends, to a far greater extent than is generally supposed, to keep his mind and spare time occupied; it consequently helps to make him a contented citizen and thereby adds to the ordered state of the community of which we in England are able to boast to-day.

This being so, the following particulars of the work of the Addiscombe and Woodside Allotments Society (1921) Limited, of Croydon, may prove helpful and interesting to other Societies who are now occupying land for allotments, either on lease direct from private owners, from a local authority who have hired the land, or in any other manner under which they are faced with the prospect of losing their ground when required for building or other purposes.

The Addiscombe and Woodside Society is believed to be the first society in the kingdom to acquire, with the assistance of the local authority, its own freehold. The executive of the Addiscombe Society decided at the end of 1920, when the society was still a war allotment society and as such not a registered society, that arrangements should be put in hand for finding a permanent home for their members when the war plots came to be given up.

It was obvious to the executive that all the grounds, about 8 in number, held at that time under D.O.R.A., and ranging from one acre to 12 acres in extent, would undoubtedly be developed as building land as soon as conditions became more normal. It was decided, therefore, to make a survey of the neighbourhood, and, if possible, concentrate on some ground, which, while actually not building land in the full sense of the term, would nevertheless be situate fairly centrally in the district, and thus be accessible for members of the society living in all parts of the district.

It should be explained here that Addiscombe, a part of Croydon, was before the War, and still is, being rapidly developed by the erection of middle-class houses. It was realised, therefore, that any ground which was in any way accessible in the district, would command a good price.

As a result of the survey, it was decided to focus attention on two fields of about 35 acres in extent, in the occupation of a local farmer. The extreme end of the ground—about 7 acres—was very wooded, and therefore unsuitable for allotment purposes. The next step was to approach the Local Authority, viz., the Corporation of Croydon, and urge that negotiations be started with the ultimate view of the society obtaining the freehold of the remaining 28 acres. How this was to come about was not clear to anyone at that time. In Croydon, however, allotment holders are fortunate in having a very sympathetic Small Holdings and Allotments Committee on the Council. This being so, negotiations were opened, but after a period of three months the society was notified by the Council that the price asked was prohibitive, and the figure named would have prevented the Society letting the plots at a reasonably low rent. The executive of the society further considered the matter and decided that whatever obstacles were in the way must, if possible, be removed. The ground decided on was the only suitable ground in the district and it was felt that every effort should be made to obtain it. At the same time the executive realised that it would not be possible to pay the high price demanded for the land. The Council were again approached, and correspondence was reopened with the owners. As a result of protracted negotiations the price was eventually substantially reduced. Even at this figure, however, after adding the necessary overhead and management charges of a society, it was considered that the plots could not be let at a reasonable rent.

One side of the ground had a frontage to a lane leading from one of the main roads in the district. This lane was marked out under the town planning scheme for a 50-ft. roadway, and negotiations were under way for development of the estate by a local builder. As a result of a conference between the writer and the Borough Engineer, it was decided to offer the frontage of the proposed allotment ground to the builder at a reasonable figure. This was eventually agreed to with the result that 3½ acres were taken from the 28 acres, leaving the society with 24½ acres at a cost which would enable it to let plots at 1s. 3d. per rod, which was considered a reasonable figure. The society thereupon decided to register under the Industrial and Provident Societies Acts and thus be in a position to issue shares to its members and thereby provide the deposit on the purchase price. Shares of the nominal value of 5s. each were issued and all members were expected to take up a minimum of £2 worth of shares. As soon as the formalities of registration were completed, the Council were informed, and they in turn approached the Ministry of Health for consent to a loan to the society under the Small Holdings and Allotments Act, 1908. This was eventually sanctioned.

By a resolution of the Small Holdings and Allotments Committee of the Croydon Corporation the Corporation decided to advance 80 per cent. of the purchase price of the land, on mortgage to a properly constituted and registered society, the society to find the balance of 20 per cent. It was decided, therefore, by the executive of the society, to raise a share capital of £600 by means of 5s. shares to provide this 20 per cent. The shares were accordingly issued and when sufficient had been taken up to provide the 20 per cent., the money was paid over to the Croydon Corporation. Although negotiations for the purchase of the land were commenced as far back as December, 1920, it was not until the end of December, 1922, that the society actually entered into possession. No member has so far been allowed to become a plotholder without first becoming a shareholder.

At the Annual General Meeting of the Society held on the 1st December, 1922, draft regulations were submitted and approved which laid down very clearly how the new ground was to be controlled by the society. Under these regulations—a copy of which was later supplied to each plotholder as he took over his plot—members were allowed to erect on their plots tool sheds of a uniform size, and these had to be erected as shown on the society's plan, on the right-hand back corner of each plot, 18 inches from any pathway. By this means, no two sheds would be back to back. It would be possible to wheel a barrow down the pathways between the plots, and the sheds when erected would give an appearance of uniformity which was essential for a well-ordered society.

Another regulation gives the General Secretary power to call on each member for at least one hour's work per month for the purpose of keeping the society's property in good order, and doing any other work necessary for the good of the society.

In order to be in a position to let plots at a rent which compares favourably with other allotments in the neighbourhood this regulation is absolutely essential. Where a society owns its own freehold it is quite impossible to consider paying for all labour required for general services, such as erection of fencing, cutting of trees, etc. In fact, instead of letting the plots at 12s. 6d. per 10-rod plot per year, the Local Authority in making their calculations, were unable in the first instance to see how they could be let at a lower rent than 18s. 6d. per plot if the Local Authority had to provide all the fencing and carry out other necessary works. It can only be done where the necessary organisation exists for meeting the difficulty and where "co-operation is the watchword" as in this society. In fact, without co-operation among all members of any allotment society, it is difficult to see how the best results can be obtained.

Before the plots were allocated all members were asked to state on a form (*a*) how much ground they required, (*b*) whether they were desirous of having their plot next to or near to a friend or friends, and (*c*) what form of assistance they would be willing to give to the General Secretary for the purpose of general requirements on the ground.

The allocation of the plots was in the hands of a sub-committee, who allotted plots on the basis that the further a man lived away from the ground, the nearer he should be to the entrance to the ground.

The sub-committee arranged at the same time to group members together as far as possible in accordance with their wishes as expressed in (*b*) on the form, and as a result practically all plotholders were satisfied with their decisions.

Obviously, in taking over ordinary pasture land for allotments —much the same as moving into an empty house—many things needed attention. The brook running through the centre of the ground and dividing the two fields had to be bridged in two places. For this purpose, the society purchased a quantity of railway sleepers and the necessary work was carried out by the plotholders. In addition, it was necessary to erect a cattle-proof fence, 810 ft. long, across the ground in order to cut off the wooded portion which had not been purchased. This work was also carried out by the members, at a cost of about ⅛th of the estimate of the Local Authority, which estimate, of course, included the cost of labour—a very big item in these days.

The executive of the society decided that in order to meet their liabilities it would be necessary to charge 1s. 3d. per rod, *i.e.*, 12s. 6d. for a 10-rod plot. In addition to this, under the rules of the society, each member has to pay a yearly subscription of 1s. per member, irrespective of the amount of ground held by him.

It should be mentioned that the society have a very strong social side, for the beneficial results of which the executive are indebted to a committee, including women, who manage the whole of the catering and decorating part of the work. Whist drives, dances, concerts, etc., are held, and in estimating their balance sheet for this year and in order to be in a position to let plots at 1s. 3d. per rod, the executive relied on a good profit from this source. A profit also was looked for from the trading side of the society—seed potatoes, pea sticks, etc. In both cases, the expectations of the executive have been justified.

The society is in its first year on its new freehold ground, and, therefore, much still remains to be done. It would appear, however, from the financial state of the society at present that no trouble will be experienced this year—probably the heaviest year for expenses—in meeting its liabilities, including repayment of mortgage to the Council, and payment of interest at the rate of 5 per cent. to shareholders.

It should be emphasised that, in piloting through a scheme of this kind many difficulties have to be met. Executives of societies should, therefore, not be daunted by these, but go ahead, determined to overcome all obstacles at all costs. Ground should be decided on and application made to the Local Authority for assistance.

Owing to the fall in wages, the raising of the necessary £600 of share capital has not been an easy matter, and may not be so for any society. Patience is necessary; enthusiasm for the allotment movement is absolutely essential; tact should and must be shown in dealing with the many parties concerned in a venture of this kind; but if the subject is properly tackled, and tackled in a determined spirit, there seems no reason why every war allotment society in the kingdom should not acquire its own freehold and thereby help to make a big contribution to promoting the happiness and contentment of our citizens.

With building extending in many directions, all allotment societies should examine their position at once with a view to providing a permanent home for their members. No time should be lost. Every society should put the necessary machinery into operation at once, and by the co-operation of all members, attain the goal for which all allotment holders strive.

The writer will be happy to assist as far as lies in his power any allotment society which may desire further information. The registered office of the Society is "Rosehaven," Shirley Road, Croydon, Surrey.

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MANURIAL TRIALS WITH OSIERS.

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The present trials are the outcome of the treatment of osiers after spraying with nicotine soap for insect pests. They were intended primarily to select the best manures, or mixture of manures, from an economical and financial point of view, with a view to further trials. The results are published as there are no records at the present time dealing with manuring of osiers. The plots for the experiments were small since it was expected that only a few would be selected for further investigation on a larger scale. In order to make the details more readily available, the results are, however, calculated for an acre. The osiers in question are for the production of rods for the manufacture of large baskets (vegetable) and hampers. Under these circumstances quality is not so important as quantity, and the larger the quantity, the larger the return, other things being equal.

After the plantation was successfully treated in May, 1920, for an attack of *Galerucella lineola* and *Crepidodera aurata*, a light dressing (½ cwt. per acre) of sulphate of ammonia was applied, to stimulate growth and tide the plants over the critical period when a second attack might occur. A part of the plantation was not treated and the marked difference between the returns from the treated and untreated areas made it evident that there were great possibilities for manurial treatment.

The soil in the plantation is a heavy loam with underlying clay and the area where the osiers are growing is generally flat, except in one place. As there is a small stream on the south side, it is an easy matter to flood the plantation during dry weather. Beyond the plantation, the ground rises sharply so that all water drains into the hollow and the stream. By this means the soil can always be kept moist even in the driest weather. The flooding is done on the water-meadow principle, and consists of a gentle soak and not a continual flush of water. By altering the direction of the water every row of plants gets the same treatment and the whole of the plantation is kept in an equal state of moisture. Beyond the light dressing of ½ cwt. of sulphate of ammonia the ground had received no manures previously.

In the spring of 1921, an area was selected for the trials. The ground had been weeded and cultivated, and the osiers were all of the same age and variety (Yellow osier). The area was marked into twenty plots, 4 × 4 yards. On the 21st April, 1921, the manures, which had been separately weighed and packed for each plot, were applied, while the dung was weighed out at the neighbouring farm. With the exception of the dung and lime, the manures were applied as a light dressing in comparison with the usual quantities used for agricultural purposes. The rates of application, calculated per acre, were as follows :—Sulphate of Ammonia 1 cwt., Nitrate of Soda ¾ cwt., Kainit 2 cwt., Basic Slag 4 cwt., Superphosphate 8 cwt., Lime 15 cwt., Dung 20 tons.

The quantities of manures used were largely tentative since there was no definite information available. Beyond the preliminary success with a very light dressing of sulphate of ammonia it was uncertain how the others would affect the osiers, and as nitrate is regarded as having a bad effect on the quality of the rods, the nitrate of soda was kept very low while the sulphate of ammonia, proving successful, was repeated at twice the first application (of ½ cwt. per acre). The plots were kept small, firstly owing to the difficulty of getting a suitably large piece of ground, and secondly as it was expected that probably the six best plots would have little between them.

Early in June the plots were inspected. Growth had commenced and a general examination showed that some of the plots were already ahead of the others. The best plots were 18 and 19; next 17 and 20; then in order 14, 15 and 16; 13 and 7; 8; 9 and 10; 12; 11; 1; 2, 3 and 4; 5 and 6.

At the end of September an examination of the plots placed the order approximately as follows:—18 was best, then 19, followed by 17 and 20, after these 14, 15 and 16; 8; while the others showed little difference.

On the 9th of December the plots were cut and weighed separately. The result is given in Table I.

TABLE I.

Produce of Manured Plots.

Plot.	Manures.	Weight of Production. lb.
1	Nitrate of Soda	12½
2	Sulphate of Ammonia	14½
3	Superphosphate	14
4	Basic Slag	13½
5	Dung	14
6	Kainit and Basic Slag	13
7	Nitrate of Soda and Superphosphate	13
8	Sulphate of Ammonia and Superphosphate	15½
9	No Manure	12
10	Lime	14
11	No Manure	11½
12	Kainit and Superphosphate	13½
13	Nitrate of Soda, Kainit and Superphosphate	14
14	Nitrate of Soda, Kainit and Lime	15
15	Nitrate of Soda and Basic Slag	16
16	Sulphate of Ammonia and Kainit	16
17	Nitrate of Soda, Kainit and Basic Slag	19
18	Sulphate of Ammonia, Kainit and Superphosphate	28
19	Nitrate of Soda, Kainit and Dung	20
20	Nitrate of Soda and Kainit	18
X	Sulphate of Ammonia	17

The general progress of the osiers during growth shows that the best plots were markedly superior to the others at a very early stage in their growth. Hence anything which stimulates early growth will probably give the best results. The weighings gave curious results, Plots 2, 7, and to a slight extent 13 and 14, were far below expectation, while the osiers flanking these plots were poor, particularly near 1 and 2. To test this a representative area of 4 × 4 yards was selected from the bulk of the osier crop which was manured with sulphate of ammonia at the rate of 1 cwt. per acre and cut. The result is given in Plot X. Soil samples were carefully extracted and it was found that clay appeared about 6 or 7 inches below the surface in a line cutting obliquely across Plots 2, 7, part of 13 and 14; for the rest of the area the clay was 9-12 inches below the surface. The clay was not a solid mass but occurred mixed with the soil and increased at lower depths.

The increase on the manured plots was in two directions (1) length and size, and (2) number. The rods were good and clean stemmed (no side branches) and in the case of Plot 18 the height was 6-7 feet. The poorer plots had fewer and smaller rods. the lowest being only about 3-4 feet high. The results are very much what one would expect, the complete manures giving the highest yields. The next point of interest is that generally superphosphate is better than basic slag. Nitrate of soda did not give quite such satisfactory results as sulphate of ammonia, even allowing for the lighter application. The explanation of this is rather difficult, it may be that the excessive moisture favours bacteria which utilise or destroy the nitrate or that it passes right down through the soil before the roots of the young rods can obtain any benefit from it.

Turning next to the economical or financial side of the trials, the cost of the manures was calculated according to the prices at the time of application. The cost of applying single manures is put at 9d. per acre and for the mixing and application of mixed manures at 1s. per acre. The cost of transport is 1½d. per bolt or bundle (of an average weight of 38 lb.) to the nearest market. The sale price per bolt is reckoned at 3s. although at times it may be considerably higher. (*See* Table II.)

The method of marketing rods varies considerably. In the present case they are sold by the bolt—a bundle measuring 1½ feet across the base. This made financial calculations very difficult as the plots were compared by weight, while the bolt is practically a measure weight. In the circumstances a very exhaustive series of weights was made, and it was found that since there were much fewer of the larger rods to a bolt than the smaller, any variation due to the individual bolt disappeared when the total was taken in bulk. Accordingly 38 lb. as the weight of the average bolt was taken as the standard. The actual marketing of the bolts of big rods and little rods showed that what at first seemed to be the introduction of a very grave error was remarkably accurate in practice and its application to the crop in general justified.

TABLE II.

Financial Results of Manuring, per acre.

	Total value of increase in crop per acre. £ s d.	Total cost of production and transport of increase per acre. £ s. d.		Profit or loss per acre on increase. £ s. d.
1	0 12 0	0 12 6	–	0 0 6
2	3 0 0	0 18 0	+	2 2 0
3	2 8 0	0 16 3	+	1 11 9
4	1 16 0	0 16 3	+	0 19 9
5	2 8 0	3 2 9	–	0 14 9
6	1 4 0	1 2 9	+	0 1 3
7	1 4 0	1 6 9	–	0 2 9
8	4 4 0	1 12 9	+	2 11 3
9				—
10	2 8 0	2 0 6	+	0 7 6
11				–
12	1 16 0	1 2 9	+	0 13 3
13	2 8 0	1 14 6	+	0 13 6
14	3 12 0	2 19 6	+	0 12 6
15	4 16 0	1 10 3	+	3 5 9
16	4 16 0	1 6 6	+	3 9 6
17	8 6 6	1 19 11	+	6 6 7
18	13 2 6	2 6 11	+	10 15 7
19	9 10 6	4 6 9	+	5 3 9
20	7 2 6	1 4 11	+	5 17 7
X	6 0 0	1 0 6	+	4 19 6

* No. 9 12 lb.—3,624 lb. per acre at 3s. lb., approx. £14 5s. per acre. Cost of production, &c., not known.

During the year 1922, the trials were much more limited, and two types were selected for quantity tests—sulphate of ammonia for 3-year-old osiers and the manures of Plot 18 for 1-year-old osiers on a higher and consequently a drier area. For the year-old osiers, three areas each of 28.5 sq. yards were selected and the manures applied as under:—

	Superphosphate	*Kainit*	*Sulphate of Ammonia*
No. 1	4 cwt.	3 cwt.	2 cwt. per acre
,, 2	3 ,,	2 ,,	1 ,, ,, ,,
,, 3	1½ ,,	1 ,,	1 ,, ,, ,,

No. 2 was at the same rate as Plot 18 of 1921.

For the 3-year-old osiers, the plots were each of 225 sq. yards. The sulphate of ammonia was applied as follows, per acre:—No. 4, 2 cwt.; No. 5, 1 cwt.; No. 6, ¾ cwt.

The results on the drier areas were very poor and the yields less than the unmanured plots of 1921. The highest was 3,396 lb. per acre, while the unmanured Plot 9 (of 1921) gave 3,624 lb. per acre.

The yields per plot were:—No. 1, 3,396 lb. per acre; No. 2, 3,227 lb. per acre; and No. 3, 3,396 lb. per acre (the same as No. 1).

The obvious conclusion to be drawn from these is that unless there is a plentiful supply of water, manures will produce no increase. Even the superphosphate failed to stimulate the roots and enable them to grow down and obtain water from a lower level. The failure of the plots on the higher ground where the increased and decreased application of complete manures was carried out, prevented any further progress in that direction.

As regards the 3-year-old osiers, there was a steady increase with each additional application of sulphate of ammonia:—No. 4, 15,440 lb. per acre; No. 5, 14,830 lb. per acre; No. 6, 12,710 lb. per acre.

The untreated area gave 11,800 lb. per acre. The increase on No. 4 is, therefore, 3,640 lb., No. 5, 3,030 lb. and No. 6, 910 lb. The large increase from Plot 6 to Plot 5 is probably due to a spell of wet weather in the early stage of the trials when weeds grew vigorously and doubtless obtained a large share of the manure. The higher applications of Plots 5 and 4 would not show this loss to the same extent.

Plot	*Value of Increase*	*Cost of Manuring*	*Profit*
4	£14 7 0	£1 15 3	£12 11 9
5	£11 19 0	£1 2 3	£10 16 9
6	£3 2 0	£0 12 0	£2 10 0

The results of the trials, although by no means conclusive, show that manuring osiers will pay, at least on certain types of soil. Although it may not be so satisfactory in the case of rods used for fine and delicate basket work, there seems no reason why it should not be successful, provided too much nitrogen is not supplied. Experiments alone will decide this point. In spite of the small size of the plots, and the errors that will arise in calculating per acre on such a small scale, and also the none too satisfactory calculation of bolts by weight, there is still such a margin that the most generous calculation for errors will not affect to any degree the financial result. The actual returns from the whole area after manuring with sulphate of ammonia show a very marked increase, particularly on the financial side, which is after all the test for the grower.

Unfortunately the area which has been under investigation is not satisfactory for large scale trials, and the difficulty of controlling experimental areas so far from the College and the difficulty of absence from departmental duties makes any further work impossible. The results are, therefore, published as they stand in the hope that it may help others with more time and better opportunities for carrying out such work.

In conclusion the writer wishes to thank A. Body, Esq., of Plymouth, without whose generous help and permission these trials could not have been carried out, and his colleagues on the staff of Seale-Hayne College, for assistance.

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LIVER ROT OF SHEEP.

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AN account of the outbreak of liver rot in North Wales in 1920-21, with a report on some spraying experiments carried out by the author against the host snail was published in this *Journal* for May, 1922, p. 154. Further observations and a continuation of the experiments are described below.

The violent outbreak of this disease in 1920-21 died down during the hot dry summer of the latter year, the host snails being reduced from extreme abundance to probably less than normal numbers. Numerous drainage and spraying operations by farmers and others further assisted in this process. The unusually cool, damp summer of 1922 resulted in some local increases, however, and on some of the wetter lands infected livers were again reported. In most cases precautionary measures were taken and no severe losses have been reported even during the wet winter of 1922-23; the only cases noted were an odd one here and there, far below the normal of average years before the epidemic.

Accounts of the epidemic and experiments undertaken in connection with it and their results will be found in the following sources :—(1) This *Journal* (see above); (2) Report of the Department of Agriculture of the University College of North Wales, January, 1922; (3) Advisory Leaflet No. 1, Department of Agriculture, University College of North Wales, September, 1922. In these publications dusting and spraying experiments are described, copper sulphate in powders and solutions being used with good results against the snails which act as intermediate host for the parasite causing the disease (*Fasciola hepatica*).

Since these articles were written there has been a good deal of discussion and observation with regard to the snails acting as intermediate host with the following important results. There are present in North Wales three distinct species of freshwater snails of the genus *Limnaea*, these being (*a*) *L. truncatula*, a small species, very abundant, and the usual carrier and intermediate host of the flat worm causing liver rot; (*b*) *L. peregra* (or *pereger*), a larger and stouter species, equally common, but generally found on softer mud than the former; and (*c*) *L. palustris*, a species as large as (or larger than) *peregra*, but with a longer, narrower, darker and more pointed shell. Further, *palustris* is a much less widely distributed species than the other two, although locally abundant, as on parts of the Malldraeth Marsh (Anglesey), the Abergele district and elsewhere. During work on these snails in Mid and North Wales the writer had several times obtained from *L peregra* young (larval) flukes indistinguishable from those causing liver rot, and so common in *L. truncatula*. Dr. Monica Taylor (in recent letters to " Nature ") believes that this snail (*peregra*) is the usual carrier in some parts of Scotland, where liver rot occurs and *L. truncatula* is scarce or absent Such being the case it becomes necessary for Welsh farmers and others to regard this second and very common species as probably dangerous, and to destroy it whenever possible. Fortunately the means advocated for the one are equally effective for the other. No incriminating evidence seems as yet to have been obtained against *L. palustris*.

Experiments with Sulphate of Ammonia and Copper Sulphate.—In the autumn of 1922 Professor R. T. Leiper drew the writer's attention to the suggestive results obtained in some Laboratory experiments carried out in the Department of Helminthology in the London School of Tropical Medicine, in which ammonium sulphate was found to kill L. *truncatula* and its eggs. Further, Dr. Khalil found that solutions of 1/1000 of the crude fertiliser killed the egg masses of *L. peregra* and *Planorbis corneus* in 6 hours.* It was therefore resolved to carry out a series of field experiments against *Limnaea* in North Wales, using sulphate of ammonia. A very suitable situation was found at Tyddyn Mawr, Holland Arms, Anglesey, and thanks are due to the owner and occupier, Mr. H. O. Williams, and his son, for their kind assistance during these experiments. Sulphate of ammonia, if successful, would have had several marked advantages (*a*) as an egg killer, (*b*) as being non-poisonous, (*c*) as having a manurial value. So far, however, it has not proved an efficient snail killer in field practice. The experiments may be summarised as follows :—

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* *Journ. Tropical Medicine and Hygiene*, March, 1922.

(*A*) The application of 30 lb. of commercial sulphate of ammonia, by hand, to 500 square yards of grass land, flooded from a damaged drain, and heavily populated with *L. truncatula*, 12th December, 1922. This dressing equalled 2.6 cwt. per acre at a cost of about £2 per acre. The amount of water present was estimated at an inch deep, giving a solution of 1/780 or 0.13 per cent. This, however, did not kill the snails, which remained unaffected. There was a slight flow of water on this area at the time of application. Laboratory experiments had indicated 1/1000 as effective against eggs.

(*B*) A ditch, about a foot deep, with a gentle flow down the centre between clayey banks, containing numerous large *L. peregra*, many *L. palustris*, and a few *L. truncatula*. This was treated (12th December, 1922) with a dust composed of 1 part of dry neutral sulphate of ammonia and 2 parts of kaolin (china clay). This latter was used as a spreader and "tracer." Application was by a hand bellows. A hundred square yards were treated at an approximate cost of £1 9s. per acre. Twenty-four hours later the death rate was found to be 70 per cent.—that in a ditch chiefly inhabited by *L. peregra*.

(*C*) A similar ditch, but wider and more stagnant, with no obvious flow. *L. peregra* was present but not abundant. Fifty square yards were dusted with equal parts of neutral sulphate of ammonia and china clay (12th December, 1922). All the snails subsequently found and examined were dead, but the numbers were not great.

(*D*) 100 square yards of damp or slightly flooded grass land (same situation as *A*) were dusted on 8th March, 1923, with equal parts of dry neutral sulphate of ammonia and china clay at the rate of 1 cwt. of each per acre. *L. truncatula* was very abundant. The results are discussed below, with (*E*).

(*E*) 60 square yards (alongside *D*) were dusted with equal parts of fine powdered copper sulphate and china clay, also at the rate of 1 cwt. of each per acre. *L. truncatula* was very abundant. 300 snails were collected 24 hours later and placed in clean water in the laboratory, and showed the following results:—

(*a*) 50 snails dusted with sulphate of ammonia, on damp mud: 10 per cent. dead.

(*b*) 50 snails dusted with sulphate of ammonia, in shallow water: 5 per cent. dead.

(*c*) 100 snails dusted with sulphate of ammonia, from mud and shallow pools: 10 per cent. dead.

(*d*) 50 snails dusted with copper sulphate, on damp mud: 100 per cent. dead.

(*e*) 50 snails dusted with copper sulphate, in shallow water: 100 per cent. dead.

The foregoing experiments would seem to show that sulphate of ammonia is of little value under field conditions in North Wales against *L. truncatula*, but has greater killing power for *L. peregra*. On the other hand, copper sulphate was as successful as in the earlier experiments, and is therefore still to be recommended, with the usual precautions as to avoidance of stocking treated ground until after heavy rain, and the exercise of care in treating flowing streams that may be used for watering stock, or may affect fishing waters, etc. An interesting case occurred in which a large and valuable flock of sheep was discovered to be grazing fields parts of which were swarming with *L. truncatula*, and nevertheless remained healthy. No larval flukes could be obtained from several large batches of these snails which were apparently not affected and were therefore, for the time being, harmless. This flock had suffered severely during the epidemic.

Several ditches, etc., cleared of snails by the use of bluestone dusts 18 to 24 months previously were re-examined and found to remain free of snails, but one flowing stream, in Anglesey, had been repopulated throughout its length with *L. peregra*, by migration from side streamlets.

In one instance several large damp grass fields swarming with *L. truncatula* (and the cause of very heavy losses in 1920-21) were ploughed and put under oats. This treatment was successful; only two specimens were detected in a damp place between furrows during subsequent examinations. These fields were again seeded down with the oats, and the resultant grass fields were practically clear of snails when examined, thus indicating a method of treatment of value on such land.

The value of ducks was also further demonstrated by the examination of a shallow stream running through the grazing lands of a series of farms, many of which were affected during the epidemic. Where the stream passed near the homesteads and ducks were kept, no snails could be discovered, but away from the buildings, where the ducks did not range, *L. truncatula* and *L. peregra* occurred, in some cases in thousands.

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"SLEEPY DISEASE" OF THE TOMATO.

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The term " Sleepy Disease " as used by the average nurseryman in this country covers a number of separate diseases, the most important of which is *Verticillium* wilt. Of the other diseases included under this general title may be mentioned *Fusarium* wilt, and root rot caused by *Vermicularia varians*, Ducomet. Plants attacked by different species of *Fusarium* following wireworm injury also come under the same category.

Verticillium wilt usually appears about the middle of April and increases in severity up to the second and third week in May. Fresh cases are rarely found during the second half of June, July and August, but the disease frequently reappears in September and the attacked plants die prematurely. *Fusarium* wilt requires a high temperature and occurs only at the hottest time of the year. Death by *Vermicularia varians* usually takes place in August or September, while cases of root rot may be found continuously through the season. As *Verticillium* wilt is the most important disease of this class, it forms the subject of the remainder of the article.*

Plants attacked by *Verticillium albo-atrum* are usually stunted in appearance, and the youngest internodes are badly developed. Under conditions of light and temperature favourable to the fungus the disease symptoms appear quite suddenly and the plant wilts while still green. During the night the plants may recover their turgidity, but wilt again as the morning advances. The leaves wither from the base of the plant upwards, adventitious roots emerge from the stem and the plant dies. Under conditions less favourable to the fungus, the process of death is much slower: yellow blotches appear on individual leaflets on the lower leaves and these leaflets wither. This process continues slowly up to the top of the plant, when death occurs. When the plant is dead the fungus within it grows out to the air, and produces a white spore-bearing layer of hyphæ which covers the surface of the stem near to the ground. A great many spores are produced and serve to disseminate the disease.

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* A full account of this disease has been published in the "Annals of Applied Biology," Part 2, Vol. 9, 1922, to which further reference should be made.

On cutting open a diseased plant in a longitudinal direction, it will be seen that the wood is distinctly brown in colour as compared with that of a healthy plant. This browning of the wood is a common phenomenon connected with the presence of a fungus, and may be seen also in plants suffering from *Fusarium* wilt, *Vermicularia* root rot, etc. *Verticillium* wilt, however, may be readily distinguished from these other diseases, for in this disease, the browning of the wood generally extends to within a few inches of the top of the plant, while in the other diseases mentioned it is rarely found higher than a foot above ground.

The causal organism, *Verticillium albo-atrum*, may be isolated readily by transferring a small piece of infected wood to a tube of sterile medium. Inoculations performed by pricking a small piece of hyphæ from a pure culture into the stem of a healthy plant invariably cause wilt in from two to six weeks according to the temperature conditions to which the plant is exposed. While wounds are an assistance to infection, it has been proved by carefully controlled experiments that they are not essential.

The fungus possesses a wide host range and during our investigation has been isolated from wilted potatoes, snapdragons, cucumbers, pepper plants, sweet peas and cotton plants. The strain isolated from a tomato plant readily attacks the above plants, also the egg plant, sycamore, and elm.

The Relation between Temperature and the Incidence of the Disease.—Monthly inoculation experiments yielded results which seemed to indicate that a close relation existed between environmental conditions, especially temperature, and successful infection. Further investigation was deemed necessary.

As a series of glasshouses, where different temperatures could be constantly maintained, was not available, inoculated plants (hypocotyl stab) were placed in different positions in the experimental houses, corridors, etc., under different average temperature conditions. Twelve plants were placed in each position, and the average temperatures were calculated from readings taken twice daily from maximum and minimum thermometers placed beside the plants. The final observations, shown in the following tables, were taken twenty-one days after inoculation, and where figures are given they represent the average obtained from twelve plants.

TABLE I.

Progress of Disease in different Temperatures.

	Frame	Corridor	Tomato House	Cucumber House
Average temp. F.	54·6°	62·4°	70·3°	77·2°
Absolute min. F.	42°	52°	54°	69°
Absolute max. F.	69°	73°	82°	92°
Date of inoculation	14/4/20	14/4/20	14/4/20	14/4/20
No. of days from inoculation ...	21	21	21	21
Ratio of wilted to total leaves ...	0/10	6/12	8/12	0/12
Height of discoloured wood above stab	15 cms.	26 cms.	28 cms.	9 cms.
No. of days from inoculation until complete wilt	49	28	28	No wilt after 80 days

While the results obtained are open to criticism because of the wide range of temperature to which the plants were submitted in any one position, certain facts emerge which have been fully confirmed by observations on commercial nurseries. Chief among these are the beneficial effects which shade and temperatures above 75° F. have upon plants suffering from wilt. Table I shows that average temperatures of 63° F. and 70° F. are favourable to the rapid progress of the disease, that of 54° F. is unfavourable, while that of 77° F. practically inhibits it. It will be seen that the organism has travelled most rapidly up the stem, as indicated by the browning of the wood, at 63° F. and 70° F., and at these temperatures also complete wilt occurred most rapidly. The results shown in Table II, while confirming the temperature relations shown in the preceding table, also show the beneficial effect of shade. While plants in the unshaded house readily wilted, those in the shaded house, although the temperature was favourable to the disease, did not wilt.

TABLE II.

	Frame	Tomato House		Cucumber House	
		Unshaded	Shaded	Unshaded	Shaded
Date of inoculation	14/4/20	14/4/20	14/4/20	14/4/20	14/4/20
No. of days from inoculation ...	21	21	21	21	21
Average temperature	62·4°F.	71·5° F.	68·9° F.	79 3 F.	77·1° F.
Ratio of wilted leaves to total leaves	6/10	3/10	0/10	0/10	0/10

General observations have also shown that temperatures between 60° F. and 75° F. with an optimum of 70-73° F. are favourable to the rapid progress of *Verticillium* wilt, which below 60° F. and above 75° F. is exceedingly slow, while suitable shading counteracts the effect of low temperatures.

A series of experiments were next arranged in which wilted plants were transferred to high temperatures to ascertain if they

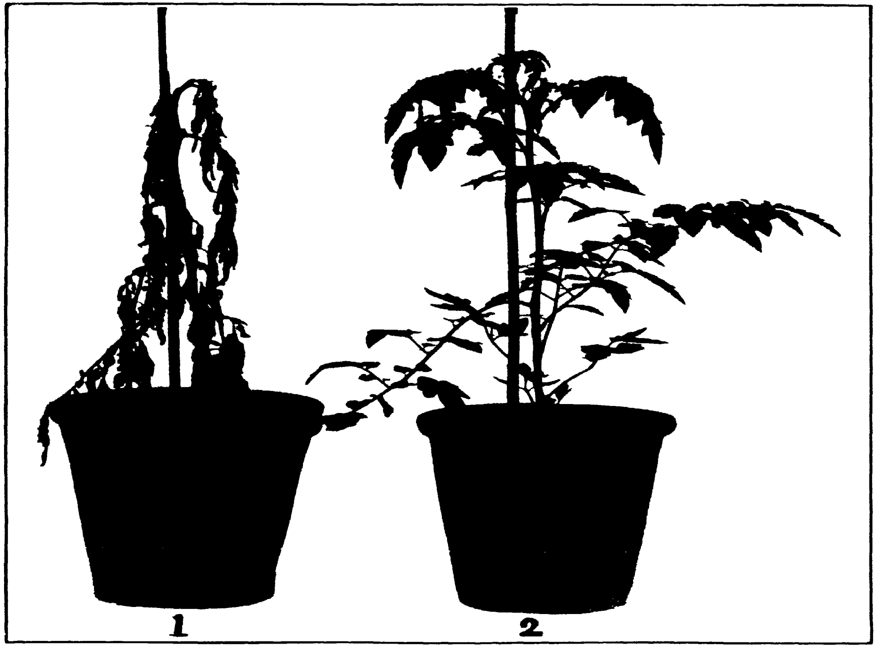

Fig. 1. (1) Wilted plant 6 weeks after inoculation with *Verticillium albo-atrum*
(2) Control plant.

(Figs 1 and 2 reproduced by kind permission of
The Association of Economic Biologists.)

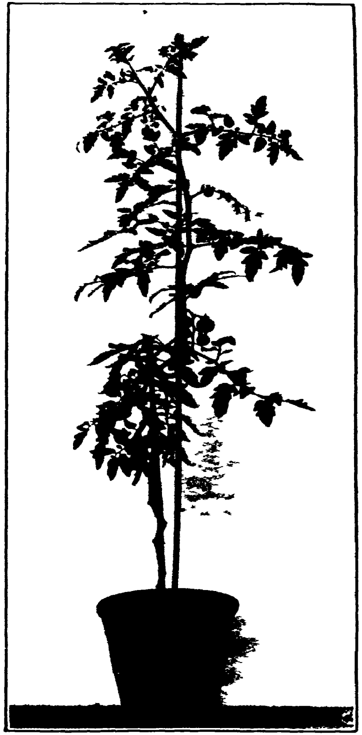

Fig 2.—Showing the wilted plant after being submitted to shade and an average temperature of 25° C. (77° F). The wilted leaves have fallen, but the plant has recovered

would recover, and if such a recovery would continue when they were returned to lower temperatures. The results given in Table III indicate that wilted plants recover when the average temperature is raised to 77° F. and they are shaded. When such a temperature is operative for a short time the effect is not a lasting one, for the plants rapidly wilt again when the temperature is lowered. Longer exposures to the high temperature produce a more lasting result, for after 75 days at 77° F. the plants remained turgid for 30 days at a temperature favourable to wilt. Table IV compares the percentage of wilted plants which recover when transferred to a shaded house at an average temperature of 77° F., with that of similar plants transferred to an unshaded house at the same average temperature.

TABLE III.

Effect of High Temperature and Shade on Wilted Plants.

No. of wilted plants	Length of time in shaded cucumber house. Average temp. 77° F.	Effect of high temperature	Length of time after returning to average temp. 70° F. before plants wilted again
12	1 day	Recovered	15 hours
12	2 days	"	15 "
12	7 "	"	2 days
12	14 "	"	3 "
12	30 "	"	16 "
12	75 "	"	30 "

TABLE IV.

Effect of High Temperature with and without Shade on Wilted Plants.

No. of wilted plants	No. of days wilt has been visible prior to experiment	Per cent. recovered in shaded cucumber house. Average temp. 77° F.	Per cent. recovered in unshaded cucumber house. Average temp. 77° F.
20	2	100	100
20	7	100	100
20	14	100	100
20	21	100	90
20	30	100	80

Plants in different stages of wilt were used, from a series where the wilt was just commencing to show to a series in an advanced stage after 30 days' wilting. All the plants recovered in the shaded house, but only a percentage recovered in that which was not shaded. The plants which did not recover in the unshaded house, being badly wilted ones, were probably desiccated before they had a chance to recover.

These observations appear to justify the conclusion that temperature is a most important factor, while shading is valuable because it assists the plant by reducing transpiration. The minimum, optimum and maximum temperatures for growth in pure culture of the strains of *Verticillium albo-atrum* utilised for the inoculation were 40° F., 74° F. and 86° F., respectively. It will be seen, therefore, that the optimum temperature for infection coincides approximately with the optimum temperature for growth in pure culture. *Verticillium* wilt is distinctly a disease of low temperatures and is most severe in spring and autumn.

Shade.—Shade, as we have seen, has a beneficial effect upon the resistance of the host to the disease. Probably this is due to retarded transpiration and consequently to the decreased rate of conduction of the water in the vessels, so that the toxic products excreted by the fungus are not carried up the plant in such large amounts.

Soil Factors.—Experiments carried out with soils of different types show that *Verticillium* wilt is not restricted to any particular type. Generally speaking, plants on soils which contain a large amount of humus yield a greater amount of disease than those growing on soils of a poorer nature. Clay soils, in virtue of their greater water-holding capacity, are cooler than sandy soils, and plants grown upon them are more prone to wilt than those grown on the latter.

Control.—Further work is in progress to determine a suitable chemical agent which will sterilise the soil and effectively cleanse it of the wilt-producing organisms. Investigations are also being carried out on the efficacy of manurial treatment in rendering the plants resistant to fungal attack, but it is too early to suggest any treatment.

Cultural Methods.—Cultural methods for the control of the wilt have been devised, and have been tested with promising results.

It is commonly held by pathologists that plants exhibiting hard growth are more resistant to disease than the more succulent types, but observations on wilt disease show in this case the reverse to be true, the harder growing varieties succumbing more readily than the more succulent ones. The only variety, Manx Marvel, which so far has proved highly resistant to *Verticillium* shows a distinctly free growth with thick stems and large leaves.

It has been specially noted that plants, starved in the early stages, or having suffered from a severe check are highly susceptible. Also it has been mentioned previously that the average temperature of the air and soil are limiting factors in the incidence of the disease. The disease is first seen in spring, when the temperature is low, but with the coming of the higher summer temperature the wilted plants recover, and the percentage mortality of the plants infected in the spring depends upon the length of time the cold weather lasts.

The incubation period for the disease varies from eight to twenty days under favourable conditions and complete wilt and death occur in from six to eight weeks after the first symptoms appear, if conditions are favourable for the fungus. Should the temperature be sufficiently raised before the plant dies, it will recover and produce a satisfactory crop during such time as the temperature remains high. Once the temperature drops in the autumn, wilt reappears, and the plant dies prematurely. Early summer temperatures, therefore, enable the plant to resist the fungus. It will at once be evident that good results may be obtained by artificially shortening the period of low temperature, and in glasshouses this may be done by increasing the boiler heat, and closing down the houses in the middle of the day.

The following cultural methods for controlling the disease have given satisfactory results. As soon as the wilt appears and it is proved that *Verticillium albo-atrum* is the cause, the average temperature of the houses should be raised above 77° F. by suitably increasing the boiler heat, regulating the ventilation, and closing down the houses for from two to four hours in the middle of the day. A thin coat of whitewash on the glass makes the conditions still more favourable for the plants. As little water as possible should be given to the roots, as heavy watering merely aggravates the wilting, but a light overhead damping helps the wilted plants to recover. The plants should be encouraged to make fresh roots by heaping up the soil round the base of the stem.

In one case sixty-eight per cent. of the plants in a nursery were showing symptoms of wilt disease before the above methods were enforced, but a fortnight after only ten per cent. remained wilted. In view of the fact that the low spring temperatures are favourable to infection by *Verticillium*, some advantage might be gained by planting later than normally, so that the higher summer temperatures may arrive by the time the plants have reached a suitable stage for infection.

Examination of the effect of kind of soil upon the incidence of the disease has shown that soils rich in humus yield a higher percentage of diseased plants than those of a poorer nature.

Results obtained on the experimental plots at this station confirm this—the greatest percentage of *Verticillium* wilt occurs on the plots receiving complete artificials with large amounts of dung.

The Elimination of Sources of Infection.—Too much stress cannot be laid on the fact that it is useless to sterilise the soil if centres of infection are allowed to exist in the neighbourhood of the nursery.

Certain workers have pointed out that *F. lycopersici* will develop much more rapidly in sterilised soil than in ordinary unsterilised soil. Presumably this is due to the fact that sterilisation eliminates a large number of bacteria and fungi organisms. We have found the same to be true for *Verticillium albo-atrum*, for plants growing in incompletely sterilised soil or re-inoculated sterilised soil have a higher percentage of disease than those in unsterilised soil. This is accentuated if the soil be exceedingly rich in humus, as is the case with sterilised cucumber soil, which is frequently used for tomato growing. The determination and elimination of infection centres thus become of vital importance. The fungal outgrowths at the base of dead diseased plants produce innumerable spores which become widely disseminated. These in themselves will not carry the fungus over the period of winter, being destroyed by drying, but they readily germinate, and feeding on decaying plant material, produce carbonised hyphæ and microsclerotia, which are able to withstand winter conditions. Close examination has been made of small pieces of plant remains which have been unearthed from nursery soils, after the crop has been removed, and numerous tomato pests, including *Verticillium albo-atrum*, have been found upon them. Thus it is important to remove completely all dead plants before the fungal outgrowths appear, and in the process of cleaning up the nursery when the crop is finished, to remove carefully as much as possible of the dead plant-remains. Careful attention to these matters will prevent the rapid spread of the disease. The best way to remove the crop, when completed, is to sever each plant about three inches from the ground before attempting to remove the roots. If the surface is quite clean before the roots are removed there is less chance of incorporating diseased material in the soil and the roots may then be carefully taken up, leaving behind only the very fine rootlets.

Another source of infection which becomes more and more evident is the contamination carried in "strikes" or baskets, and a considerable number of cases have been noted, where infection with various diseases came from these articles. Such baskets may be so mixed at the market, that when they are returned, those from one nursery are sent to another and so disease is spread. Baskets should not be taken near to the growing plants for fear of introducing some new trouble, and during the winter months all baskets should be sterilised in readiness for the coming season. The importation of young plants from other nurseries is a procedure to be deprecated, for it is a fruitful means of disease transmission. Contaminated water from surface wells is a constant source of infection with many diseases, and care should be taken to use a pure water supply. Potatoes and antirrhinums should not be grown in the vicinity of tomatoes as they are susceptible to *Verticillium.*

Disease Resistant Varieties.—The production of resistant varieties has offered the most satisfactory and in some cases the only effective means of controlling a number of plant diseases. An attempt is now being made to raise a *Verticillium*-resistant tomato, the necessity being borne in mind of producing a plant which will yield a good crop of well-formed fruit.

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THE PRINCIPLES OF POULTRY FEEDING.

II.

Value in Comparison with other Feeding Stuffs.—The value of any feeding stuff can be estimated with accuracy only after taking into consideration many factors, and poultry-keepers desiring to familiarise themselves with these factors should study "*Rations for Live Stock,*" by Professor T. B. Wood, of Cambridge University.*

Briefly, it may be said here that whilst experimental work in connection with cattle, horses, sheep and pigs has advanced so far that the quantities of digestible proteid and starch equivalent required daily by idle horses, horses on heavy work, store cattle, cows giving different quantities of milk, etc., are known, no similar information regarding poultry is available.

In the meantime, probably the best method for the poultry-keeper who wishes to estimate the value of any feeding stuff for his poultry will be to examine the digestible nutrients shown in the table, to take into consideration the amount of fibre and ash or mineral matter which the feeding stuff contains, and then to calculate the proportion between the proteids on the one hand and the carbo-hydrates and fats on the other hand which the total ration contains. This proportion is known as the nutritive ratio and is shown in the table for each individual feeding stuff. For example, in the case of maize and maize meal, it will be seen that for every part of proteids there are 11 parts of carbo-hydrates and fat. This ratio is calculated by multiplying the percentage of oil by 2.5, adding the percentage of digestible carbo-hydrates and dividing the result by the percentage of digestible proteid. For example, in the case of maize :—

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* Miscellaneous Publication No. 32, to be obtained from the Ministry, 10, Whitehall Place, S.W.1. Price 6d. net, post free.

$$\frac{(\text{Digestible oil} \times 2\ 5, + \text{Soluble Carbo-hydrates.}}{\text{Digestible Proteid.}}$$

$$\frac{(3\ 9 \times 2\ 5) + 65{\cdot}7}{7{\cdot}1} = \frac{75\ 45}{7\ 1} = 10\ 82 = \text{approx } 11,$$

therefore nutritive ratio is as 1 is to 11.

This ration is found in practice to be too wide to form the whole ration for laying hens; the proteid content is too low and the fat-producing constituents are too high. The maize therefore is given in conjunction with other feeding stuffs richer in proteid and of a less fattening nature. It is necessary therefore to calculate the nutritive ratio of the total mixture, and the simplest way of making this calculation is to ascertain the total digestible proteid and the total digestible carbohydrates and fat in the mixture and then work out the ratio as in the case of a single feeding stuff. Take for example the following ration :—

2 lb. of bran, 4 lb. middlings, 1 lb. of Sussex ground oats, 1 lb. of maize gluten feed, 1 lb. of clover meal, 1 lb of fish meal.

Assuming that the grain feed used with this ration is

2 lb. maize, 1 lb. wheat, 1 lb. oats,

and that the poultry receive during the day equal weights of the grain and mash rations; it is of little value calculating the nutritive ratio of the mash alone, and therefore the total food given through the day must be considered. Now on referring to the table, it is seen that bran contains 10.6 per cent. digestible proteid and therefore 2 lb. of bran will contain 0.212 lb. of this constituent. The table also shows that bran contains 5 parts carbo-hydrates and fats to every part of proteid and therefore 2 lb. of bran will contain 1.06 lb. digestible carbo-hydrates and fats. Following this method, the following calculation can be made:—

	Digestible Proteid.				*Digestible Carbo-Hydrates and Fats.*
2 lb. bran	0·212	×	5	=	1·060
4 „ middlings (coarse)	0·552	×	4	=	2·208
1 „ Sussex ground oats	0·080	×	7	=	0·560
1 „ alfafa (lucerne)	0·032	×	2	=	0·064
1 „ maize gluten feed	0·200	×	3	=	0·600
1 „ fish meal	0·727	×	0	=	0·000
2 „ maize (kibbled)	0·142	×	11	=	1·562
1 „ wheat	0·102	×	7	=	0·714
1 „ oats	0·080	×	7	=	0·560
Total...	2·127				7·328

therefore nutritive ratio of total day's ration

$$= 1 : \frac{7\cdot328}{2\cdot127} = 1 : 3\cdot4.$$

This ration for mash and grain is one which is often used, but it has a narrow or high nutritive ratio and it is doubtful whether such a high quantity of proteid in the daily feed is either necessary or advisable.

The following ration gives a wider nutritive ratio and is of a less forcing nature, but would probably produce equally as many eggs as the first ration with less risk to the health of the birds. A ration with a narrower nutritive ratio than 1 : 4 is probably unnecessary for laying poultry and there is some evidence to show that an even wider ratio than 1 : 4¼, which is shown by the ration below, would give equally good results, whilst being cheaper and safer to use.

	Digestible Proteid.				*Digestible Carbo-Hydrates and Fats.*
2 lb. bran	0·212	×	5	=	1·060
2 „ middlings	0·276	×	4	=	1·104
2 „ Sussex ground oats	0·160	×	7	=	1·120
3 „ maize meal	0·213	×	11	=	2·343
1 „ alfalfa (lucerne)	0·032	×	2	=	0·064
1 „ fish meal	0·727	×	0	=	0·000
1 „ wheat	0·204	×	7	=	1·428
1 „ oats	0·080	×	7	=	0·560
1 „ maize (kibbled)	0·071	×	11	=	0·781
	1·975				8·460

therefore nutritive ratio of total day's ration

$$= 1 : \frac{8\cdot460}{1\cdot975} = 1 : 4\cdot28.$$

Neither the composition of the egg nor of the body of the hen is a correct guide in deciding upon a suitable nutritive ratio. The following figures show the composition of the egg and also of the hen's body:—

Egg:—Protein 11·1, Fat 10·12, Ash 1·0

$$\text{therefore nutritive ratio} = 1 : \frac{10{\cdot}12 \times 2{\cdot}5}{11{\cdot}1} = 1 : 2{\cdot}28$$

Fowl:—Protein 12·49, Fat 2·98, Ash 0·57

$$\text{therefoie nutritive ratio} = 1 : \frac{2{\cdot}98 \times 2{\cdot}5}{12{\cdot}49} = 1 : 0{\cdot}50.$$

Based on this analysis, the nutritive ratio of the egg itself is very high, namely, 1 to 2.28 whilst that of the body of the fowl is even higher, 1 to 0.59. To feed laying hens on a ration possessing so narrow a nutritive ratio as either of these would not only be likely to endanger the health of the birds, but would be a wasteful and expensive method of feeding.

It should be clearly understood that the nutritive ratio is not a complete guide to the feeding value of a ration. Such questions as bulk, the inclusion of mineral salts, palatability and general suitability as a poultry food must also be taken into consideration, but generally speaking, the nutritive ratio is a useful guide to the poultry-keeper in making up his rations.

Much doubt exists in the minds of many poultry-keepers as to which is the cheapest food stuff to buy at the various market prices quoted, and in "*Rations for Livestock*," column 17 of the tables shows the "linseed cake equivalent" of many of the feeding stuffs. The figures in this column give the number of lb. of average linseed cake required to produce in quadrupeds as much growth, fat, milk or work as 100 lb. of the feeding stuff to which the figures apply, and so they permit a reliable comparison of the productive value of different feeding stuffs. As linseed cake is not used, except perhaps to a negligible extent, in feeding poultry, maize meal has been taken for comparison for the tables of this leaflet. The last column of the tables shows approximately the number of lb. of maize meal which have the same productive value as 100 lb. of the feeding stuff indicated. It should not be inferred from these figures that maize meal should be given undue prominence in a ration, or that it should be used to an undue extent by itself; but other considerations being equal, the figures show the relative value of maize meal compared to other feeding stuffs in a poultry ration. The maize meal equivalent is also useful for arriving at a rough estimate as to the cheapest feeding stuffs in the market. Strictly speaking, the manurial value should be taken into consideration before this comparison is made, but since poultry manure at present is not regarded by the poultry-keeper as of the same importance as the farmer regards farmyard manure, this consideration may be ignored at the moment.

Feeding Stuffs.	Chemical Analyses.						Digestible Nutrients.				
	Dry Matter.	Proteid.	Fat.	Soluble Carbo-hydrates.	Fibre.	Ash.	Proteid.	Oil.	Soluble Carbo-hydrates.	Nutritive Ratio.	Maize Meal equivalent (per 100 lb. Maize).
Cabbage	11·0	1·5	0·4	5·9	2·0	1·2	1·1	0·2	4·6	1: 6	6·5
Maize and Maize Meal ...	87·0	9·9	4·4	69·2	2·2	1·3	7·1	3·9	65·7	1:11	100·0
Millet	87·5	10·6	3·9	61·1	8·1	3·8	8·0	3·1	45·8	1: 7	70·0
Oats	86·7	10·3	4·8	58·2	10·3	3·1	8·0	4·0	44·8	1: 7	71·0
Rye	86·6	11·5	1·7	69·5	1·9	2·0	9·6	1·1	63·9	1: 7	88·0
Pasture Grass	20·0	3·5	0·8	9·7	4·0	2·0	2·5	0·4	7·3	1: 4	10·7
Rye Grass	24·8	2·9	0·7	11·5	7·1	2·6	1·8	0·3	7·4	1: 7	8·2
Clover	19·0	3·4	0·7	8·1	5·2	1·6	2·5	0·5	6·3	1: 4	9·0
Meat Meal	89·2	72·2	13·2	—	—	3·8	67·2	12·5	—	—	114·0
Fine Middlings	87·3	15·7	3·4	64·0	1·8	2·4	13·2	3·0	52·0	1: 5	89·0
Coarse Middlings or Sharps	86·5	16·4	5·0	56·2	3·3	8·6	13·8	4·3	45·5	1: 4	75·0
Pollards	86·7	14·3	4·8	55·6	7·7	4·3	11·6	4·0	44·5	1: 5	69·0
Yeast (dried)	95·7	48·5	0·5	35·5	0·5	10·7	41·6	0·2	29·2	1: 1	86·0
Blood Meal	86·0	81·0	0·8	1·5	—	2·7	72·7	0·8	—	—	78·0
Wheat	86·6	12·1	1·9	69·0	1·9	1·7	10·2	1·2	63·5	1: 7	88·0
Sunflower Seed	92·5	14·2	32·3	14·5	28·1	3·4	12·8	30·7	10·3	1: 8	118·0
Distillers' Grains (wet) ...	26·2	8·4	3·0	10·4	3·6	0·8	6·2	2·6	6·4	1: 2	18·0
Distillers' Grains (dry) ...	92·0	27·7	11·6	40·8	10·1	1·8	19·6	10·2	25·3	1: 3	65·0
Buckwheat	85·9	11·3	2·6	54·8	14·4	2·8	8·5	1·9	42·3	1: 6	62·0
Barley and Barley Meal ...	85·1	8·6	1·5	67·9	4·5	2·6	6·5	1·2	62·2	1:10	85·0
Dari	88·9	9·6	3·8	71·2	1·9	2·4	7·7	3·0	60·5	1: 9	91·0
Rice	87·4	6·7	0·4	78·0	1·5	0·8	5·8	0·2	75·8	1:13	100·0
Beans and Bean Meal ...	85·7	25·4	1·5	48·5	7·1	3·2	20·1	1·2	44·1	1: 2	77·0
Peas and Pea Meal	86·0	22·5	1·6	53·7	5·4	2·8	19·5	1·0	49·9	1: 3	83·0
Hemp Seed	91·1	18·2	32·6	21·1	15·0	4·2	13·7	29·3	16·8	1: 7	117·0
Soya Beans	90·0	33·2	17·5	30·5	4·1	4·7	29·5	15·8	20·8	1: 2	96·0
Soya Bean Meal	88·7	44·7	1·5	31·9	5·1	5·5	40·3	1·4	24·7	1: 1	87·0
Milk (sweet)	12·8	3·4	3·9	4·8	—	0·7	3·2	3·9	4·8	1: 4	21·3
Milk (skim)	10·0	3·5	0·4	5·0	—	0·8	3·3	0·4	5·0	1: 2	11·4
Linseed	92·8	24·2	36·5	22·9	5·5	3·8	19·4	34·7	18·3	1: 5	134·0
Linseed Meal	88·2	35·7	3·1	33·9	9·0	6·5	30·8	2·8	27·2	1: 1	74·0
Buttermilk	9·2	3·6	0·8	4·1	—	0·7	3·4	0·8	4·1	1: 2	11·4
Maize Germ Meal	89·3	13·0	13·5	55·1	4·1	3·6	10·4	12·8	45·8	1: 7	103·0
Barley Brewers Grain (dry)	89·7	18·3	6·4	45·9	15·2	3·9	13·0	5·6	27·6	1: 4	51·0
Barley Brewers Grain (wet)	32·4	7·5	2·8	14·6	6·1	1·4	5·5	2·4	9·1	1: 3	20·0
Barley Malt Culms	90·0	24·4	2·0	42·4	14·0	7·2	19·9	1·5	30·9	1: 3	38·3
Fish Meal	87·0	55·6	4·4	2·1	—	2·7	72·7	0·8	—	—	65·0
Maize Gluten Feed	89·6	23·5	3·4	56·7	3·5	2·5	20·0	2·7	49·3	1: 3	91·0
Maize Gluten Meal	90·9	35·5	4·7	47·5	2·1	1·1	30·6	4·4	42·6	1: 2	101·0

Price comparison is arrived at in the following manner:—If the price of maize meal is £10 5s. 0d. per ton and the price of feed oatmeal £11 15s. 0d. per ton, on referring to the table we find that the maize equivalent of oats is 71, *i.e.*, 71 lb. of maize meal is of the same productive value as 100 lb. of oats; the price of feed oatmeal, namely, £11 15s. 0d. is therefore divided by 71, showing that the cost per unit of maize meal equivalent in oats is about 3s. 4d. The cost per unit of maize meal would be £10 5s. 0d. divided by 100, namely, approximately 2s., so that unless the poultry-keeper for some particular reason desires to use feed oatmeal instead of maize meal, maize meal is much the cheaper purchase at these prices.

Feeding Stuffs.	Chemical Analyses.						Digestible Nutrients.				
	Dry Matter.	Proteid.	Fat.	Soluble Carbo-hydrates.	Fibre.	Ash.	Proteid.	Oil.	Soluble Carbo-hydrates.	Nutritive Ratio.	Maize Meal equivalent (per 100 lb. Maize).
Sussex Ground Oats ...	86·7	10·3	4·8	58·2	10·3	3·1	8·0	4·0	44·8	1: 7	71·0
Oatmeal	91·4	14·0	9·4	65·0	1·2	1·8	—	—	—	—	—
Groats	91·6	14·3	8·7	65·0	1·8	1·4	—	—	—	—	—
Wheat Bran	86·4	13·5	3·9	53·0	10·6	5·4	10·6	2·8	38·0	1: 5	53·0
Clover Meal	83·5	13·5	2·9	37·1	24·1	6·0	8·5	1·7	26·0	1: 5	26·0
Turnips	8·5	1·0	0·2	5·7	0·9	0·7	0·6	—	5·2	1: 9	5·1
Swedes	11·5	1·3	0·2	8·1	1·2	0·7	1·1	—	7·5	1: 7	8·1
Mangolds	13·2	1·2	0·1	10·2	0·8	0·9	0·7	—	9·4	1:14	8·5
Potatoes	23·8	2·1	0·1	19·7	0·9	1·0	1·1	—	17·7	1·1	22·3
Parsnips	15·0	1·3	0·3	11·3	1·2	0·9	1·0	0·1	10·9	1·12	12·4
Carrots	13·0	1·2	0·2	9·3	1·4	0·9	0·8	0·1	8·9	1:12	10·0
Kohl Rabi	12·7	2·0	0·1	8·2	1·4	1·0	0·7	—	7·4	1:11	9·6
Mangolds (Yellow-fleshed Globe or Tankard) ...	13·2	1·2	0·1	10·2	0·8	0·9	0·7	—	9·4	1:14	8·1
Mangolds (Long Red) ...	13·1	1·0	0·1	10·3	0·8	0·9	0·7	—	9·5	1:14	8·1
Kohl Rabi (leaves)	13·5	2·8	0·4	7·1	1·6	1·6	1·9	0·2	5·7	1: 4	7·5
Kale (Thousand Head) ..	14·8	2·5	0·3	8·7	1·7	1·6	1·8	0·2	7·0	1: 5	9·5
Rape	14·1	2·8	0·8	5·7	3·5	1·3	2·0	0·5	3·9	1: 3	6·3
Lucerne (beginning to flower)	24·0	4·5	0·8	9·6	6·8	2·3	3·2	0·4	6·3	1: 3	7·7
Clover (Alsike)	15·0	3·3	0·6	5·1	4·5	1·5	2·1	0·4	3·6	1: 3	5·1
,, (Crimson)	18·5	2·8	0·7	6·9	6·2	1·9	2·1	0·5	5·2	1: 5	6·7
Lucerne (before flowering)	24·0	4·5	0·8	9·6	6·8	2·3	3·2	0·4	6·3	1: 2	7·7
,, (in full flower) ..	24·0	3·9	0·8	9·3	7·8	2·2	2·7	0·4	5·7	1: 3	7·4
Palm Nut Kernels	91·6	8·4	48·8	26·8	5·8	1·8	8·0	46·5	22·5	1:16	17·5
Cocoanut Cake Meal ...	88·7	19·5	6·7	42·5	13·6	6·4	15·3	6·5	35·4	1: 4	81·0
Hemp Seed Meal	88·7	34·8	1·7	16·8	25·7	9·3	26·2	1·3	8·9	1: 1	36·6
Palm Nut Kernel Meal (extracted)	90·0	19·0	2·0	49·0	16·0	4·0	17·1	1·9	43·5	1: 3	79·0
Rape Meal (extracted) ...	89·3	36·9	3·1	32·7	9·3	7·3	30·7	2·4	26·2	1: 1	66·0
Sunflower Cake (decorticated)	90·4	37·4	13·8	20·4	12·1	6·7	33·6	12·2	14·6	1: 1	86·2
Sesame Meal (extracted) ...	94·0	46·4	2·4	26·7	7·7	10·8	41·8	2·2	14·9	1: 1	69·0
Apple Pomace (fresh) ...	25·8	1·5	1·1	17·1	4·7	1·4	0·7	0·5	11·9	1:18	15·5
,, ,, (dried) ...	88·3	4·0	3·5	51·8	27·2	1·8	1·6	1·7	36·3	1:26	38·2
Maize Malt Culms	86·5	20·7	14·5	39·6	5·8	5·9	17·4	12·4	34·9	1: 4	68·8
Maize Meal (from cornflour)	85·0	9·2	3·8	68·7	1·9	1·4	5·5	3·5	63·7	1:13	96·0
Rice Feeding Meal	87·1	12·0	12·0	45·2	8·0	10·2	6·8	10·2	36·2	1: 9	83·0

Take again a comparison between the grains dari and maize. If the price of dari be £9 per ton and maize £9 10s. 0d. per ton, then the price per unit of maize meal equivalent in dari is £9 divided by 91, which equals, roughly, 2s., whilst the price per unit of maize at £9 10s. 0d. per ton is about 1s. 11d., and on this basis maize is a cheaper grain for the poultry-keeper to purchase than dari.

General.—Methods of feeding poultry in practice are largely influenced by considerations of economy in labour and by the system of poultry-keeping adopted. Where poultry are kept merely as a subsidiary occupation or in very small numbers merely for the purpose of the family supply, economy in labour is not of such vital importance as it is on a large commercial egg farm, where thousands of birds are kept and reared. In the latter case all superfluous work must be rigidly cut out and the routine of the farm organised in such a way that, with due regard to efficiency, labour is cut down to the absolute minimum.

Again, where the poultry enjoy free range over an ordinary mixed farm and are thus enabled to find a great deal of their own food, the methods of feeding adopted differ considerably from those of the average commercial egg farm, where the birds are more or less permanently confined on limited areas of land.

The conditions under which poultry are kept in this country vary so widely and there is such a large variety of feeding stuffs which can successfully be utilised for poultry, that in an article of this character the subject of feeding can only be treated upon general lines and no definite rules can be laid down as to the best methods of feeding or the best rations to employ.

In the case of backyard poultry-keepers, who wish to use household scraps and surplus material from the garden and allotment, it is impossible to lay down definite rules for the practical application of the foregoing principles, as the quality and quantity of the materials available for use vary so greatly. It should, however, be remembered that meat and fish scraps are rich in proteids and therefore tend to narrow the nutritive ratio, whilst material of a vegetable character will tend to widen it.

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MONTHLY NOTES ON FEEDING STUFFS.

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Feeding Value of Alfalfa Meal.—A correspondent has asked for information on the value of alfalfa meal for poultry, and cows and pigs in winter. Alfalfa is best known in this country as lucerne, and alfalfa meal consists of the dried lucerne plant disintegrated into a meal. Like clover meal it is chiefly used for poultry kept on an intensive or semi-intensive system, where supplies of green food are scarce or not available. At 18s. 6d. per cwt., the price quoted by the correspondent, the cost per unit starch equivalent works out at no less than 12s. It is, therefore, a very dear feeding stuff, and in the case of pigs and cows it would be more advantageous to feed lucerne hay rather than lucerne meal, if it is desired to feed this material at all. Green lucerne is very useful as a supplement to any rations containing maize or maize meal, since, besides supplying protein it is fairly rich in the ash constituents needed by growing stock.

Use of Cod Liver Oil and Fish Meal.—Recent work carried out at the Rowett Research Institute, Aberdeen, and reported in the Scottish Journal of Agriculture, deals with the value of cod liver oil for feeding purposes, and the connection between fish meal feeding and taint in bacon.

In the poultry tests, feeding tests were carried out concurrently at the three Scottish Colleges of Agriculture, and at the Rowett Institute, the object being to test the influence of cod liver oil on (*a*) growth, (*b*) egg production, and (*c*) hatchability of eggs. The basal ration used was the diet usually fed at each station, and cod liver oil was added in small amounts (usually 1 c.c. per bird).

Growth.—The results of these tests indicate that, with an ordinary commercial diet, there is no material advantage gained in feeding cod liver oil. In the tests in question, the control birds without cod liver oil put on as much weight as those with.

Egg Production.—In these tests, the birds were kept under strictly controlled conditions, and the results obtained showed no evidence of any beneficial effects that could be ascribed to either cod liver oil or linseed oil.

Hatchability.—With regard to this experiment eggs from hens in the egg production experiment were hatched to see whether the cod liver oil or linseed oil had any influence on the hatchability of the eggs. From the data at present available it would appear that the percentage hatchability was not increased by the use of either cod liver oil or linseed oil.

Fish Meal and Taint in Bacon.—Pig feeding experiments were carried out at the Rowett Institute to determine (1) whether fishy taste in bacon was caused by the addition of fish oil to the diet of pigs, and (2) whether the addition of fish oil results in improved health or rate of growth. The space at the writer's disposal does not allow a comprehensive treatment of these

DESCRIPTION.	Price per Qr.		Price per			Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.								
	s.	lb.	s.	£	s.	£	s.	£	s.		s.	d.
Wheat, British - -	—	—	11/6	11	10	0	16	10	14	71·6	3/–	1·61
Barley, British Feeding	—	—	9/3	9	5	0	12	8	13	71	2/5	1·29
„ Danubian „	30/–	400	8/6	8	10†	0	12	7	18	71	2/3	1·20
„ Persian „	27/0	„	7/7	7	12	0	12	7	0	71	2/–	1·07
Oats, English White -	—	—	11/6	11	10	0	14	10	16	59·5	3/8	1·96
„ „ Black & Grey	—	—	11/2	11	3	0	14	10	9	59·5	3/6	1·87
„ Scotch White -	—	—	12/8	12	13	0	14	11	19	59·5	4/–	2·14
„ Canadian No. 2 Western	29/3	320	10/3	10	5	0	14	9	11	59·5	3/3	1·74
„ No. 3 „	27/9	„	9/9	9	15	0	14	9	1	59·5	3/1	1·65
„ Feed -	27/3	„	9/6	9	10	0	14	8	16	59·5	2/11	1·56
„ American - -	25/6	„	8/11	8	18'	0	14	8	4	59·5	2/9	1·47
„ Argentine - -	24/6	„	8/7	8	12	0	14	7	18	59·5	2/8	1·43
Maize, American - -	41/–	480	9/7	9	12	0	13	8	19	81	2/3	1·20
„ Argentine - -	41/3	„	9/7	9	12	0	13	8	19	81	2/3	1·20
Beans, Rangoon - -	—	—	8/3	8	5	1	13	6	12	67	2/–	1·07
Millers' offals—												
Bran, British - -	—	—	—	6	0	1	8	4	12	45	2/1	1·12
„ Broad - -	—	—	—	7	0	1	8	5	12	45	2/6	1·34
Fine middlings (Imported) - -	—	—	—	8	10	1	3	7	7	72	2/1	1·12
Coarse middlings (British) - -	—	—	—	8	0	1	3	6	17	64	2/2	1·16
Pollards (Imported)	—	—	—	6	2	1	8	4	14	60	1/7	0·85
Barley Meal - - -	—	—	—	9	12	0	12	9	0	71	2/6	1·34
Maize „ - - -	—	—	—	10	5	0	13	9	12	81	2/4	1·25
„ Germ Meal - -	—	—	—	8	12	1	0	7	12	85·3	1/9	0·94
„ Gluten-feed -	—	—	—	8	15	1	7	7	8	75·6	1/11	1·03
Locust Bean Meal -	—	—	—	8	0	0	10	7	10	71·4	2/1	1·12
Bean Meal - - -	—	—	—	12	7	1	13	10	14	67	3/2	1·70
Fish „ - - -	—	—	—	16	5	4	9	11	16	53	4/5	2·37
Linseed - - -	—	—	—	21	0	1	12	19	8	119	3/3	1·74
„ Cake, English (9°/ₒ oil)	—	—	—	10	10	1	19	8	11	74	2/4	1·25
Cottonseed Cake, English (Egyptian Seed) (5½°/ₒ oil)	—	—	—	7	5	1	16	5	9	42	2/7	1·38
„ „ Egyptian (5½°/ₒ oil)	—	—	—	7	2	1	16	5	6	42	2/6	1·34
Coconut Cake (6°/ₒ oil)	—	—	—	8	7	1	11	6	16	73	1/10	0·98
Palm Kernel Cake (6°/ₒ oil)	—	—	—	5	10*	1	4	4	6	75	1/2	0·62
„ „ Meal (2°/ₒ „)	—	—	—	4	17	1	5	3	12	71·3	1/–	0·54
Feeding Treacle - -	—	—	—	5	2	0	9	4	13	51	1/10	0·98
Brewers' grains, dried, ale	—	—	—	6	7	1	4	5	3	49	2/1	1·12
„ „ „ porter	—	—	—	5	17	1	4	4	13	49	1/11	1·03
„ „ wet, ale	—	—	—	0	17	0	9	0	8	15	0/6	0·37
„ „ wet, porter	—	—	—	0	15	0	9	0	6	15	0/5	0·22
Malt Culms - - -	—	—	—	8	0*	1	15	6	5	43	2/11	1·56

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of June and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 1d.; P_2O_5, 4s. 4d.; K_2O, 3s.

tests, but the main facts are as follows:—4 groups of pigs were fed, the main diet being a mixture of maize 10 parts, oats 1 part, sharps 1 part, fish meal 2 parts. In addition, Group 1 received cod liver oil (2 oz. to every 15 lb. of mixed meals); Group 2 herring oil; Group 3 olive oil; Group IV maize. The maize given to Group IV was added in amount sufficient to yield the same starch value as the oils.

The rates of gain in weight of the four lots were uniform, the addition of vitamin A rich cod liver oil, for the period under test, showing no beneficial result.

The amount of oil fed to one pig out of each group was increased towards the end of the test to 1¾ oz. per day to intensify any possible tainting effect that might be produced. The bacon from all the pigs was too oily. The bacon from the herring oil group had a markedly offensive fishy taste and was quite uneatable. The cod liver oil group also had a distinct fishy taste. In a previous experiment at the Rowett Institute it was shown that taint was produced from fish meal containing 6·4 per cent. of oil, but not from that containing only 2·3 per cent. of oil. The results of these experiments indicate that the oil in fish meal is the source of taint, and the tendency of fish meals to cause a taint in bacon is in proportion to the percentage of oil present.

FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s.	£ s.	£ s.		s. d.	d
Wheat	8 17	0 16	8 1	71·6	2 3	1·20
Oats	7 8	0 14	6 14	59·5	2 3	1·20
Barley	8 12	0 12	8 0	71·0	2 3	1·20
Potatoes	2 4	0 4	2 0	18·0	2 3	1·20
Swedes	0 18	0 2	0 16	7·0	2 3	1·20
Mangolds	0 17	0 3	0 14	6·0	2 3	1·20
Good Meadow Hay	3 19	0 14	3 5	31·0	2 1	1·12
Good Oat Straw	2 2	0 7	1 15	17·0	2 1	1·12
Good Clover Hay	4 8	1 1	3 7	32·0	2 1	1·12
Vetch and Oat Silage	1 18	0 8	1 10	14·0	2 2	1·16

* * * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending July 11th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.10	13.15	13.10	12.17	16. 7
" " Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.12*	13.12*	13.12*	13.12*	(N)13. 1
" " " neutral (A. 25¾ per cent.)	14.15*	14.15*	14.15*	14.15*	(N)13.11
Kainit (Pot. 12½ per cent.)	...	..	...	1.17	3. 0
" (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 5	3. 3
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11. 0	4. 7
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
" " (T.P. 30 per cent.)	...	...	...	3. 0§	2. 0
" " (T.P. 26 per cent.)	2.13§	2.10§	...	...	...
" " (T.P. 24 per cent.)	2. 9§	2. 6§	2. 7§	...	...
" " (T.P. 20-22 per cent)	...	2. 3§	.	2. 7§	2. 4
" " (T.P. 18 per cent.)	2. 3§	...	2. 0§	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	3.15	2. 2
" (S.P. 30 per cent.) ...	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7. 2†	7. 0	6.10	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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Shipment of Live Stock to New Zealand.

THE New Zealand Government have notified the Ministry that the shipment of cattle, sheep and pigs from this country to the Dominions will in future be subject to the following conditions:—

(1) For one month from the date of an outbreak of Foot-and-Mouth Disease no shipments may be made: provided, however, that an outbreak in one country shall not be held to prohibit shipments from the others—*e.g.*, an outbreak in England will not prevent shipments of cattle, etc., from Scotland or Ireland.

(2) After one month from the date of the last outbreak, cattle, sheep or pigs may be shipped at London, Liverpool or Glasgow to New Zealand from any part of the country, provided that, until three months have elapsed from the date of an outbreak, no shipment shall be made of cattle, sheep or pigs

which have been, since the date of that outbreak, within a radius of 15 miles round the seat of the outbreak.

(3) Provided that special authority may be given to permit shipment of cattle, sheep or pigs from approved areas after segregation in approved premises at the port of loading for 14 days, provided that during that period outbreaks of Foot-and-Mouth Disease had not occurred at the port of segregation nor in the areas from which any of the animals originated, nor had become epidemic in character.

(4) The fodder accompanying the animals must be the product of a county where no Foot-and-Mouth Disease has existed for six months prior to date of shipment, and must be sent *direct* from such county to the ship's side, accompanied by a statutory declaration from the supplier as to its origin.

It will be necessary for the New Zealand Government Veterinary Officer (New Zealand Government Offices, 415, Strand, London, W.C.2.) to be personally satisfied as to origin of any fodder shipped, and approval must be obtained in each case before definite arrangements are made as to purchase.

The above also applies to fodder accompanying horses.

(5) No fodder will be allowed to be landed in New Zealand.

(6) The usual owner's declaration and Veterinary Certificates must be furnished.

* * * * * *

Damage by Marking of Sheep.

THE Ministry desires to draw the attention of farmers and flock owners to the damage which is caused to the wool and skin of sheep by careless pitch-branding. From information which the Ministry has received, it is very evident that considerable damage and loss are annually incurred from this cause, and an examination of pelts shows that in many cases the branding iron has inflicted a wound which has so marked the skin that the dressed pelt is useless for any good class of trade. The consequent serious loss could easily be obviated if branding were carefully done. Neither branding iron nor pitch should be so hot as to burn the skin, but just hot enough to leave a clean neat mark. Burning is especially apt to occur if branding is done at clipping time or too soon after clipping, and farmers should therefore be careful not to perform clipping and branding at the same time. The best time to brand sheep is a week or two after clipping, when the wool has grown a little.

There is reason to believe that hill sheep are more liable to be damaged by pitch branding than the better conditioned sheep of the lowlands, but if sufficient care is not taken lowland sheep will be damaged no less than the others. An investigation is being made with a view to finding some satisfactory alternative method of marking sheep The difficulty in the past has been that while pitch or tar branding is liable to spoil both the wool and the pelt, alternative preparations have proved to be non-permanent or to be otherwise unserviceable.

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The World's Dairy Congress.

IT is expected by the World's Dairy Congress Committee for England and Wales that about 30 persons from this country will form the English delegation to the World's Dairy Congress to be held at Washington on 2nd and 3rd October, at Philadelphia on 4th October, and at Syracuse on 5th-10th October next.

The opportunity will be taken by some members of the delegation of visiting places of general interest in the United States. At Washington, the delegates will have an opportunity of inspecting the Government's laboratories and experimental stations, &c. At Syracuse, the National Dairy Exposition will be held at the same time as the Congress and complete exhibits in connection with various branches of the milk industry in the United States and Canada, from dairy cattle to the latest machinery for the manufacture of dairy products, will be on view. There will be an international dinner on the evening of 10th October, at which it is expected representative dairy scientists and industrial leaders from all parts of the world will be assembled. Any further information can be obtained from the Secretary of the Committee for England and Wales at the offices of the Ministry of Agriculture, 10, Whitehall Place, S.W.1.

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Report of the Experimental and Research Station, Cheshunt.

THE high form of intensive cultivation practised by glasshouse growers has problems of its own which are not easily dealt with at any of the ordinary Agricultural Research Stations, and the industry was particularly fortunate in being able to set up a special station at Cheshunt to investigate problems associated with glasshouse crops.

The Station has made very considerable progress, and its Eighth Annual Report (1922) contains much valuable information relating to the tomato and cucumber crops and their diseases. The Director has given some interesting notes on "Mosaic Disease," which, though commonly associated with potatoes, yet, nevertheless, attacks other plants, including tomatoes and cucumbers. The experiments on this disease recorded in the report are a valuable addition to our knowledge of the subject.

The Station has received a special grant from the Ministry to study the effect of charging the atmosphere in which the plants are growing with large amounts of carbon dioxide gas, and the report gives an account of the preliminary investigation that has been made. This is a particuarly important problem which has been arousing much interest in the industry.

Certain pests, like wood-lice and red spider are ever troublesome to glasshouse crops, and growers will therefore welcome the recommendations for their control made by the Station Entomologist.

Generally, the report is an extremely helpful and important contribution to literature on glasshouse cultivation; and the logical way in which the recommendations have been drawn from the results of experiments will be convincing to the practical grower.

* * * * * *

Poultry Research.

THE Ministry has received the approval of the Treasury and the Development Commission to a total capital expenditure of £4,850 on a scheme for assisting scientific research in poultry breeding, nutrition, and disease. The breeding and nutrition research work under the scheme will be carried on at the Cambridge School of Agriculture, and the disease research work at the Ministry of Agriculture's Veterinary Laboratory at New Haw, Weybridge. One-fourth of the total capital expenditure will be contributed by the poultry industry itself, and this amount will be collected by the National Poultry Council. The remaining three-fourths will be a grant from the Development Fund out of the moneys provided for agricultural development and research under the Corn Production Acts (Repeal) Act, 1921. The entire cost of maintenance will be provided out of the same fund until 31st March, 1927.

The Scheme also provides for poultry educational work and commercial experiments at Harper Adams Agricultural College, Newport, Salop, for practical breeding experiments for egg-production at a centre in the North of England, and for experiments in breeding for table poultry production at a centre in the South of England. Arrangements are, however, not yet complete for a beginning to be made on these three subsidiary parts of the scheme.

* * * * * *

Experiments in the Preservation of Eggs.

EXPERIMENTS in the preservation of eggs were carried out in the Poultry Department of Cornell University, U.S.A., in 1916-1918, and the results are described in the Journal of the American Association of Instructors and Investigators in Poultry Husbandry for June, 1919.

The treatments tried were:—dipping in hot water for six seconds, dipping in boiling water for six seconds, coating with vaseline, coating with paraffin wax and with a mixture consisting of five parts vaseline to two parts paraffin wax, and preserving in solutions of sodium compounds. After treatment some of the eggs were kept under cellar conditions and some in cold storage.

One very striking fact brought out was that paraffin wax apparently had a detrimental effect on the eggs which were treated with it. One lot of eggs was dipped in melted paraffin wax so that each egg was entirely coated. Half of these eggs were placed in cold storage and the other half kept under cellar conditions. When these eggs were examined it was found that all of them were rotten. It would seem, therefore, that coating with paraffin wax is worse than useless since the cold storage eggs which were not treated at all were mostly fit to eat. One lot of eggs was then coated with a mixture of vaseline and paraffin wax in the proportion of five to two, and half the eggs were placed in cold storage and the rest kept under cellar conditions. Of the eighty eggs kept under cellar conditions all but twelve were rotten, and these twelve were not fit to eat. Of the eggs kept in cold storage only 9.1 per cent. were fit for use, the balance being either sour or musty, although their candled appearance was fairly good. Another lot of eggs was treated with vaseline alone, and kept in cold storage for fifteen days longer than the lot just mentioned. These kept in much better condition, only 2.6 per cent. being unfit for consumption as against 90.8 of the former lot. This seems to show that paraffin wax promotes decay in eggs which are stored for long periods.

Treatment of eggs with oil or vaseline apparently improves the keeping quality. Eggs were dipped in hot oil for six seconds and then placed in cold storage, while others were coated with vaseline and placed in cold storage. Both of these were much better than the untreated cold storage eggs. Some of the eggs which were treated with hot oil were kept under cellar conditions and only 8.7 per cent. were found to be unfit for use, where untreated eggs would no doubt have been either entirely dried up or rotten. The chief objection to the use of oil or vaseline is that the appearance of the egg is spoiled by the glassy look. Dipping in hot water instead of hot oil is quite satisfactory except that the air cells are nearly as large as in untreated cold storage eggs and are more apt to be broken than in the case of the oil-treated eggs. So far as the quality of the eggs is concerned there is very little difference between the two methods of treatment.

Another interesting fact which was brought out is that sealing eggs in fruit jars is a poor method of preservation. A number of eggs treated with hot oil and some which had been immersed in hot water were sealed in glass fruit jars and part kept in the cellar and part in a room which was much colder than an ordinary cellar. When examined at the end of nine months, all of these eggs were rotten.

Another section of the trials dealt with the use of solutions containing sodium, in order to test a theory that the sodium in the water-glass used for home preservation is the chief cause of its preservative effect and therefore any sodium compound would do as well as water-glass. Acting on this suggestion, the following compounds containing sodium were tried:—ordinary hard soap, sodium carbonate and sodium benzene sulphanate. Sodium salicylate was also considered, but was found to be too expensive to be practical. The solutions were made up so that they contained practically the same amount of sodium as the water-glass solution. The results obtained were that eggs preserved in the soap solution were fully as good as those preserved in water-glass, while those in the sodium carbonate and sodium benzene sulphanate were all spoiled. The reason for this difference appeared to be that in the case of the soap solution a coating of what was judged to be a calcium soap had formed on the shell of the eggs. Moreover, the solution had thickened in a manner similar to the thickening of the water-glass solution, so that none of the solution had entered the egg. On the other hand, both of the other solutions remained watery and in both cases the solutions had entered the eggs and spoiled them for eating. Moreover, in the case of the sodium benzene sulphanate no germicidal effect was observed, but on the contrary bacteria appeared to be encouraged by it.

So far as the experiments have been carried, therefore, the results are chiefly negative, but two interesting effects have been noticed. The first is that paraffin wax for some reason has a bad effect upon eggs. The second is that apparently it is not the sodium in water-glass which alone has the preservative effect: it is rather the combination of the silica, stopping up the pores, and the sodium, preventing the growth of bacteria in the solution, which keeps the eggs fit to eat.

* * * * * *

AGRICULTURE ABROAD.

Agricultural Education in Queensland.

AN interesting Act providing for Agricultural Education has recently been passed by the Federal Parliament of Queensland, the objects of which are to fit boys to follow agricultural pursuits, to train girls in domestic science, and to enable the more advanced students to take degrees and diplomas in agriculture. The Act provides for the setting up of a temporary Board of Agricultural Education, whose chief functions are to advise as to the allocation of moneys voted by Parliament for the purpose of agricultural education, to investigate and report on the establishment and administration of agricultural schools and classes, and to issue bulletins dealing with agricultural education and cognate subjects. At a later date the Board may be superseded and its functions discharged by a Superintendent of Agricultural Education appointed by the Governor in Council.

Upon the recommendation of the Board of Agricultural Education, the Governor in Council may establish whole or part-time agricultural schools, day or evening classes, and hostels for the accommodation of the students. In addition, "any society, association, or body of persons" may make application for the establishment of an agricultural school or agricultural classes in a particular locality, and, providing *inter alia* the applicants can produce satisfactory evidence that they have already raised a sum of money equal at least to one-third of the estimated capital expenditure, the Governor in Council may, on the recommendation of the Board, establish such schools or classes, and may contribute the balance of the sum required. The whole annual cost, upkeep and maintenance of these schools or classes will be defrayed out of State funds. The schools and classes are to be subject to State supervision and inspection, the Committees of Management being constituted and appointed in such manner as the Governor in Council may approve, after consultation with the Board. The agricultural education so provided is, with few exceptions, to be free.

Provision is also made in the Act for the contribution of a sum, not exceeding two-thirds of the capital cost, towards providing an agricultural section or agricultural classes in State-aided Grammar Schools and Technical Colleges.

* * * * * *

Importation of Pure-bred Live Stock into the United States.

THE new Customs Tariff of the United States of America, which came into force on 22nd September, 1922, provides that any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free, provided that it is pure bred, of a recognised breed, and duly registered in a book of record recognised by the U.S. Secretary of Agriculture for that breed. Otherwise, the duties on live stock are as follows:—cattle weighing less than 1,050 lb., 1½ cents per lb.; weighing 1,050 lb. or more, 2 cents per lb.; sheep and goats, 2 dollars per head; swine, ½ cent. per lb.

The U.S. Department of Agriculture has now issued regulations (B.A.I. Order No. 278) laying down the procedure that must be followed to secure duty-free importation:—

Under these regulations the Bureau of Animal Industry is authorised to issue certificates of pure breeding. To obtain these certificates importers have to apply to the Bureau in a prescribed form giving particulars as to the animals to be imported. With the application certificates of registration and pedigree, issued by the custodian of one of the books of record referred to below, are to be furnished to the Bureau with an affidavit from the owner, agent or importer that the animals so imported are the identical animals described in the certificates of record and pedigree.

The Bureau also requires with the application a certificate from the seller or his agent giving the breed, sex, name, and registry number of each animal sold to the importer, the date of sale, the place of purchase, and the name and address (in the United States) of the purchaser.

If the application is found satisfactory certificates to that effect will be issued and forwarded to the Collector of Customs at the port of entry. Certificates of pure breeding will not, however, be issued until the description of the animals taken by an inspector of the Bureau of Animal Industry at the port of entry is received at the Department at Washington.

The Order contains a list of recognised breeds and books of record across the seas. The names of the following British breeds, with the name of the Society publishing the book of record, are included in the list:—

Cattle.—Aberdeen-Angus, Ayrshire, Devon, Galloway, Guernsey, Hereford, Highland, Jersey, Kerry and Dexter, Red Poll, Shorthorn, Sussex, Welsh.

Sheep.—Cheviot, Cotswold, Dorset Horn, Hampshire Down, Kent or Romney Marsh, Kerry Hill, Leicester, Border Leicester, Lincoln, Oxford Down, Shropshire, Southdown, Suffolk, and Wensleydale.

Horses.—Clydesdale, Hackney, Shetland Pony, Shire, Suffolk, Thoroughbred, Welsh Pony, and Cob.

Pigs.—Berkshire, Large White (Large Yorkshire), Tamworth.

Before any additional breed can be added to this list the custodian of its book of record must submit to the Department a complete set of the published volumes of such book of record together with all rules affecting the registration of animals. The Department will then consider the case on its merits.

Communications should be addressed to *The Chief of the Bureau of Animal Industry, Department of Agriculture, Washington, D.C.*

* * * * * *

Work of the Lithuanian Ministry of Agriculture.

ONE of the most active of the Lithuanian Ministries is the Ministry of Agriculture, as is appropriate in a country where the majority of the inhabitants are engaged in agriculture. Its programme includes agricultural education, the training of teachers to give agricultural instruction to pupils in elementary schools, improvement of live stock, and the encouragement of associations of agriculturists for the purpose of improving Lithuanian agriculture and marketing its products.

The Ministry has founded agricultural courses in many districts and, in order to reach the more remote regions, travelling lecturers are largely employed. The teaching is free to all and lasts three months. In conjunction with the municipalities the Ministry is establishing district grain cleaning stations and measures are being taken for the improvement of live stock. For the latter purpose 90 Middle White, Large White, and Berkshire boars have been bought in England at an average of £17, and a large quantity of Orpington eggs has been imported for sale to poultry-keepers. Among other associations which are aided by the Government, the Shavli Union combines all the district agricultural associations of the northern portion of Lithuania, and is arranging the export of agricultural produce to England.

* * * * * *

Farm Labour in Belgium.

AT a recent meeting of the Belgian Central Chamber of Agriculture, M. Rasquin gave an address* on the depletion of agricultural labour. He indicated that the question was not a new one in Belgium, but that since the War and especially during last year, the dearth of workers had become a serious menace to the agricultural industry.

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* Published in the March, 1923, issue of the *Journal de la Société Centrale d'Agriculture de Belgique.*

In the polder regions workers crossed the borders into Holland to receive the benefit of increased wages due to the rate of exchange, while in the more urban areas they willingly abandoned the fields for the local factories. In the communes contiguous to railway stations considerable numbers of workers, attracted by increased wages, travelled daily or weekly to the French industrial centres, and so neglected the Belgian countryside. In December over 40,000 labourers travelled to France each week, and of these it is estimated that one-fifth were agricultural workers. During the previous May the exodus increased to 120,000 against 60,000 for the corresponding month before the War.

Although it seemed clear that the better wages and shorter hours of industrial pursuits were the principal causes of the desertion of the farms, the attractions of town pleasures were also held to be a strong contributory cause. The fascination of cinemas in the cities was regarded as being such an important factor in attracting workers from the countryside that France had voted 500,000 francs for the organisation of cinema shows in rural areas. Workers were also introduced to town life through the demands of military service and frequently decided to settle in garrison towns rather than tolerate the inconveniences of separation from their families. The exodus from the countryside was also greatly encouraged by the extensive issue of cheap weekly tickets by the Belgian railways.

As regards possible remedies. M. Rasquin proposed that the system of giving bonuses on production might be extended so that agricultural workers would be rewarded for increased production or for reducing labour in any way. The worker should be given every facility for producing his own food, and by working on his own account he would become a collaborator with his employer. The questions of accommodation and housing needed thorough attention. It was suggested further that family allowances should be given after a stay of six months on a farm at the rate of 10 francs per child per month up to a maximum of 40 francs. This system of allowances was already established in the province of Liége and operated in a fairly satisfactory manner.

Above all, the speaker held that every facility should be extended to enable the worker to become a proprietor by offering advances for the purchase of small holdings and by minor concessions such as exemption from stamp duty and registration.

From the agricultural point of view labour exchanges had proved ineffective as they were located in the big cities, and the only remedy lay in their being subsidised by the Belgian Ministry of Agriculture and set up in the centres of agricultural districts.

It was pointed out that there appeared to be no serious obstacle to following the lead of France and importing Polish labour during the busy seasons. Reports indicated that Polish workers in general gave satisfaction. but it was considered advisable to return imported workers to their own country as soon as the seasonal work was completed, as otherwise there was a risk of their becoming a charge on public relief funds.

* * * * * *

International Congress and Exhibition of Social Economy at Buenos Aires.

AN International Congress and Exhibition of Social Economy will be held at Buenos Aires in Sept., 1924, under the auspices of the "Museo Social Argentino," an unofficial institution in friendly relations with the Argentine Government. The Congress will deal, *inter alia*, with agricultural questions, *e.g.*, comparison of the importance of agriculture and commerce and industry in various countries, organisation of agricultural credit and of international commerce in agricultural produce, etc.

Besides delegates representing national or municipal authorities anyone interested can, on payment of a fee, attend the Congress.

A copy of the preliminary programme can be seen at the Office of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1. Inquiries should be addressed to the "Museo Social Argentino," Maipú 126, Buenos Aires, Argentine Republic.

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QUESTIONS IN PARLIAMENT.

Grubbing of Hops.—Sir A. Holbrook asked the Minister of Agriculture, in the House of Commons on the 4th July, whether he has received any request from hop growers in the country to cancel the proposed restriction of the 1923 hop crop; whether his attention has been called to the injury which would be inflicted by such restriction on a large number of growers whose whole capital is invested in the industry, as well as upon many branches of labour and trade associated therewith; and whether he will consider the desirability of cancelling the order for restriction?

Sir R. Sanders replied :—"I am aware that the call to restrict the 1923 hop crop has been very unwelcome to many hop growers who have been replanting the acreage which had been compulsorily grubbed in 1917, but I think that most growers recognise that no other course was possible, on consideration of the fact that the consumption of beer has fallen far below that which was anticipated by those in closest touch with the trade. As I have already explained, should an average crop be produced and picked on the acreage under hops which obtained at the beginning of the year, a very large surplus over requirements would result. The Hop Controller would be unable to take this surplus from growers as he would have no prospect of selling it. Growers were therefore advised of the situation in January last in a notice issued from the Ministry, and they were recommended to arrange to restrict their production in the coming season. It was suggested that this might be undertaken this year as a temporary measure by a careful overhauling of the gardens, weeding out old and worn out plants, etc., and without resorting to permanent grubbing, until the position of the hop industry, which ultimately depends on the consumption of beer, could be more clearly foreseen. The answer to the last part of the question is therefore in the negative."

Entertainments Tax on Agricultural Shows.—In reply to a question asked by Mr. Lamb in the House of Commons on the 4th July, the Financial Secretary to the Treasury said that, under the clause which was added to the Finance Bill on the 2nd July, exemption from Entertainments Duty may be granted in respect of agricultural shows which, *inter alia*, consist solely of an exhibition of the products of agriculture, or of materials, machinery, appliances or foodstuffs used in the production of those products, or displays of skill by agricultural workers in work pertaining to agriculture, together with a band. Where an agricultural show includes exhibits outside those mentioned, the question whether exemption from Entertainments Duty can be granted depends upon whether such exhibits, if forming a separate exhibition, could have been exempted under any other provision of the law.

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Foot-and-Mouth Disease.—A further outbreak occurred at Skeffling on 29th June, the premises involved adjoining those on which the original outbreak of disease occurred on 20th June. The restrictions in this district have been relaxed from time to time, and are now applicable only to a small area immediately surrounding the infected premises.

Bedfordshire.—On 3rd July, a fresh centre of disease appeared amongst pigs, on premises at Stevington, some four miles from Bedford. The usual restrictions were applied in connection with this outbreak. Ten further outbreaks have since been confirmed on premises within a few miles of the first.

Hampshire.—On 25th July a new outbreak appeared at Alton, Hants. Further particulars will be given in next month's *Journal.*

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REPLIES TO CORRESPONDENTS.

Manurial Value of Feeding Stuffs.—C. V. asks why the manurial value of P_2O_5 in the note to the table on p. 167 of the *Journal* for May is charged at 4s. 6d. per unit, whereas on p. 169 the unit price of soluble phosphate is given as 2s. 3d.

Reply: The unit price in the footnote on p. 167 is for phosphoric acid (P_2O_5). The unit prices on p. 169 are for total phosphates (as tricalcic phosphate). The unit price of insoluble phosphates is usually calculated (as explained at the top of p. 11 of Leaflet No. 72) from the price per ton of steamed bone flour, after making allowance for 1 per cent. of nitrogen. Thus £6 17s. – 15s. 5d.=£6 1s. 7d. This divided by 60 gives approximately 2s. 0½d. per unit tricalcic phosphate and, multiplying 2s. 0½d. by 2·2 (see the rules for conversion on p. 3 of the leaflet) approximately 4s. 6d. per unit P_2O_5.

Red Spider.—E.M.G. asks whether Cox's Orange Pippin apple trees infested with Red Spider (specimens sent) are likely to be seriously damaged. Also for treatment to be applied.

Reply: The Red Spider you enclose appears to be the usual species (*Tetranychus pilosus*) found upon apples when growing in the open. It is seldom that this mite causes any serious damage, and although traces of their attack on the buds and leaves you send can be seen, judging from the small amount of material they could hardly be regarded as responsible for the major part of the injury.

There are signs of considerable caterpillar attack, Apple Blossom Weevil appears also to be present, and also Apple Sucker, while the margins of the young leaves are somewhat suggestive of weather injury. The orchard should therefore be examined rather carefully before you finally decide that the Red Spider is the pest to be tackled. If you come to this conclusion, then you might try one of the Red Spider washes indicated in the enclosed leaflet, or you might care to try the following, which appears to have been found exceptionally effective against this particular mite in the U.S.A.—Lime-sulphur in water, 1 per cent., with the addition of 6 lb. sulphur paste and 1 lb. resin fish-oil soap to each 100 gallons. The latter could with advantage be replaced by any good brand of potash soft soap.

Wheat Bulb Fly.—H.P. asked in April for the name of maggots found in the stems of wheat which was being destroyed and the remedy; also if rolling would be of service.

Reply: The wheat sent was found to be severely attacked by the Wheat Bulb Fly. The grubs were in all cases practically full grown, and if the sample was representative of the field, little further spread of the attack should take place.

Under these circumstances rolling would certainly be of value, but no further treatment was suggested. Wheat which had already escaped was not likely to become attacked, and it was only necessary to decide as to whether a sufficient plant was left on the field. If this was not the case, barley, which would not be attacked by the fly, could be sown, and a mixed crop taken.

In general, attacks by the Wheat Bulb Fly are found to be worse on land which has been fallowed or has been thinly covered by a crop during the latter half of the preceding summer.

In regard to treatment, apart from avoiding the sowing of wheat on land bare during July and August, the only measure which can be taken is to watch the wheat crops carefully so as to detect an attack in the early stage. An application of such a dressing as nitrate of soda will then be of value in assisting the crop to grow away from the attack, but it is of course necessary to detect the presence of the pest at an early stage.

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Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W. 1.

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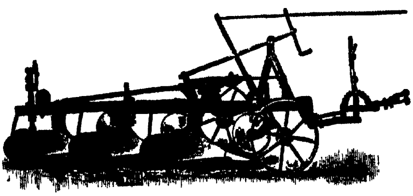

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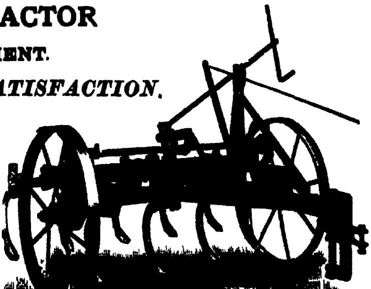

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE
Vol. XXX. No. 6.

SEPTEMBER, 1923.

NOTES FOR THE MONTH.

Distribution and Prices of Meat, Poultry and Eggs.

A THIRD Interim Report,* dealing with meat, poultry and eggs, has now been issued by the Departmental Committee on Distribution and Prices of Agricultural Produce. The first and second reports, on milk and milk products and on fruit and vegetables respectively, were noticed in the *Journal* for May and July.

The Committee obtained a large amount of information from representatives of producers, distributors, and consumers, and, in addition, received from a great number of retailers detailed particulars of their general trading experience.

It is pointed out that unlike milk, fruit and vegetables, which normally reach the consumer in the same form as that in which they leave the farm, live stock are subjected to various processes, such as the slaughtering of the animals, the dressing and cutting up of the carcases, and in the case of bacon, curing and smoking. These necessary processes add to the complexities and costs of distribution: they may also increase the number of intermediaries between the farm and the home.

It is plainly of importance to both producers and consumers that these intermediary operations should be carried out as efficiently and inexpensively as possible. It is further of importance that there should be a better understanding of the relationship of the agencies through which agricultural produce is distributed, and of the constituent elements in the price which the consumer pays. All engaged in live stock or poultry production should therefore purchase and study the Report. Diagrams show the different courses, sometimes direct, sometimes through the hands of middlemen, which meat, poultry and eggs may take in their journey from the farm to the home.

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* The Report can be obtained through any bookseller or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. (Cmd. 1927, price 5s.).

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In concluding its Report the Committee says, as regards meat:—

"We have investigated the conditions of the system of marketing and distributing meat in this country, and have set out the methods and costs in all their details so far as we have been able to ascertain them. It appears that, generally, the intermediaries concerned have increased their charges *pro rata* to their expenses, or to the change in the value of the meat with which they are dealing. We observe that retailers, however, have gone a little further and appear definitely to have increased their percentage margin of profit during recent years, and, as a class, to have improved their relative financial status in the community. We have also drawn attention to certain marketing, processing and distributive charges which might with advantage be revised.

We have indicated such improvements in the marketing of fat stock and meat as appear to us to be practical, and we earnestly commend these to the producers and distributors concerned. We are of opinion that meat traders, both wholesale and retail, should endeavour to give the best possible service in the distribution of home-produced meat, and, in particular, that they should endeavour to popularise the consumption of those cuts of the carcases which are now in poor demand. We are further of opinion that retailers should make an effort to reduce the price of the home-produced article at an early date, especially if an effective demand for the poorer cuts can be successfully stimulated and the loss on them reduced. Producers can assist distributors, and themselves obtain considerable benefit, by marketing the type of animal which experience shows is best suited to the requirements of the retail trade."

As regards poultry and eggs the Committee concludes its Report as follows:—"The outstanding feature of the poultry industry as we see it at the present time is the immense opportunity for expansion and development which awaits the home producer. Imports of both poultry and eggs are appreciably below their pre-war dimensions, and it should be his concern to see to it that they do not recover. To that end, though increased production and increased attention to breeding are essential, it is perhaps even more important that he should make an earnest effort to ensure that his produce reaches the market as efficiently and attractively packed, and as fresh as, if not fresher than, the imported article. There can be little doubt that producers in those Continental countries which, owing to internal conditions, have temporarily ceased to export poultry produce to these shores will sooner or later seek to re-enter the British market. They can only be resisted by the home producer enlarging and consolidating his position."

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The Agricultural Credits Act, 1923.

THE Agricultural Credits Act, which received the Royal Assent on 31st July, provides the following credit facilities for agriculturists:—

Section I empowers the Public Works Loan Commissioners to lend money to "approved associations" for the purpose of making advances on mortgages, also to lend money direct to borrowers, subject, in both cases, to certain conditions. The amount secured by the mortgage must be repayable within a period of 60 years, and must not exceed 75 per cent. of the value of the land, as ascertained to the satisfaction of the Public Works Loan Commissioners at the date when the advance by the Commissioners is made. In the case where the repayment extends over the full period of 60 years, the rate of interest and sinking fund will be approximately 5½ per cent. It should, however, be borne in mind that these facilities are limited to those farmers who agreed to purchase their holdings not earlier than the 5th day of April, 1917, nor later than the 27th day of June, 1921, and that the land comprised in the mortgage must be wholly or mainly agricultural land.

Agriculturists eligible for, and desirous of taking advantage of, the facilities offered by this Section, can do so by making formal application to the Farmers' Land Purchase Company, 1, Great George Street, Westminster, S.W.1, or to the Secretary, Public Works Loan Board, Old Jewry, E.C.2.

Under Section 2 of the Act, new facilities are placed in the hands of farmers, smallholders, allotment holders, and other agriculturists, for obtaining short-term loans, to meet such expenses as the purchase of seeds, fertilisers, feeding stuffs, breeding and other live stock, machinery and implements, and the erection of silos, Dutch barns, fencing, etc.

For this purpose the Minister of Agriculture and Fisheries is empowered to promote the formation of Agricultural Credit Societies, having for their object, or one of their objects, the carrying on of the business of combining the credit of their members, so as to enable them, with the assistance of advances from the Minister, to make loans to their members, repayable within a period not exceeding 5 years, for such agricultural purposes as may be approved by the Minister.

The share capital of such societies will consist of an unlimited number of £1 shares, on which 5s. per share must be paid up on allotment. There is no limit to the number of shares that any member may hold, but every member must hold at least one share. Once a society has been formed and has been registered under the Industrial and Friendly Societies Acts, a member may make application to his society for a loan up to £5 for each £1 share held by him, provided that this sum shall not exceed one-tenth of the total share capital of the society for the time being issued. Thus it will be possible for a member who has taken 20 shares in a society, upon which he has paid up a total sum of £5, to obtain a loan of £100, for a period not exceeding 5 years.

The distinctive features of an Agricultural Credit Society such as is contemplated by the Act, are :—

(1) It rests on the fundamental principle of the mutual responsibility of its members;

(2) It is local—its members living within a comparatively small area, and being well known to each other;

(3) The liability of each member is limited to the full value of the shares in the society held by him;

(4) It has a right, subject to certain conditions, to borrow money from the State for the purpose of making loans to its members.

Although such societies are intended solely for the assistance of persons engaged in agriculture, membership is open to any person sufficiently interested in promoting the prosperity of local agriculture, to be willing to lend his capital and his credit for the purpose.

Those interested in the matter, or desirous of forming an Agricultural Credit Society, should communicate with the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Section III of the Act extends the facilities offered by the Improvement of Land Acts. The owners of agricultural estates, who wish to undertake permanent improvements such as the erection or extension of farm buildings and cottages, the making of roads, sewers, drains, etc., or the erection of silos, can obtain full particulars from the Lands Improvement Company, 1, Great George Street, Westminster, S.W.1, which operates under the Improvement of Land Acts.

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Farm Institutes.

THE Ministry has published a brief summary of the courses provided at the Farm Institutes which have been established in England and Wales. There are now thirteen institutions of this type, of which eight have been started since the War. Last session the attendance was quite satisfactory, about 80 per cent. of the total accommodation being filled. The majority of the institutions provide winter courses in agriculture lasting for about 20 or 22 weeks, and in the summer, when the male students are required at home on the farm, dairying courses are provided for women. In a few cases, however, a year's course in agriculture, including the summer, is held. Horticulture and poultry-keeping figure in the curriculum. In all cases except one, farms typical of the district are attached to the Institutes, and serve to make the instruction of an essentially practical type.

The main purpose of the Farm Institute course is to enable a boy to leave his farm for the slack winter season of about six months, and during that time to become instructed in the broad scientific principles underlying the operations to which he is accustomed, or will have to be accustomed as time goes on. His interest is awakened, he is taught the why and the wherefore of many established customs which perhaps he had hitherto taken for granted, and generally he becomes imbued with a sense of the importance of "science with practice"—a condition which, in these days of progressive scientific farming, will be of enormous value to him in later years. It is well not to claim too much for the Farm Institute course. The object is not to provide training in science, or, on the other hand, practical experience in farming. The time available and the season at which the course is held preclude both these aims. It does not purport to give a complete training in agriculture, nor is it to be regarded as a stepping stone to the Agricultural College. It is primarily a "refresher," to take the farmer's boy out of the rut of established custom, and give him an interest in the unknown which will help him to take advantage in the future of all the immense stock of new knowledge which our scientists are day by day accumulating.

The Farm Institutes now in existence are situated in the counties of Cheshire, Cumberland and Westmorland, Essex, Hants, Herts, Lancashire, Northants, Somerset, Stafford, Suffolk, Carmarthen, Denbigh and Monmouth. A full list of the courses which are being held at these Institutes will be published in a subsequent issue of the *Journal.*

* * * * * *

Crops and Live Stock in 1923.

A PRELIMINARY statement of the Acreage under Crops and Grass, and Number of Live Stock in England and Wales in 1923, compiled from the annual agricultural returns collected on 4th June, was issued by the Ministry on 4th August, and appears on pp. 567-570 of this issue of the *Journal.* The statement shows that, compared with last year, the arable area has fallen by 129,000 acres, while that of permanent grass has increased by 44,000 acres, and there is also an increase of 78,000 acres in the area of rough grazings. The reduction in the arable area is mainly accounted for by the corn, pulse, and potato crops, the decline under these three heads being 451,000 acres, 82,000 acres, and 94,000 acres, respectively. On the other hand there has been an increase of nearly 300,000 acres in the area of clover and rotation grasses, and a small increase in the area of roots.

The number of horses on agricultural holdings has fallen by 59,000, but other classes of live stock have all increased. The number of cows and heifers is the largest on record, and the numbers of ewes and sows kept for breeding also show substantial increases.

Drainage Works for the Relief of Unemployment, 1923-24.

AN account of the work accomplished in connection with drainage works for the relief of unemployment in 1922-3 is given on p. 519 of this issue. In this connection it may be stated that the Government have now decided that, subject to the consent of Parliament, moneys shall be made available to enable drainage works for the relief of unemployment to be continued in the coming autumn and winter. The grants will be available only for combined schemes for the improvement of groups of holdings or properties, and not for field drainage work.

Drainage authorities, who have normal staff available, may proceed with the preparation of schemes, but no new staff for the purpose may be engaged, and no expenditure of any kind incurred, until the necessary sanction is afforded by the Ministry. No works may be started before 15th October, 1923.

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The Agricultural Index Number.

THE general index number of the prices of agricultural produce shows an increase from 51 per cent. above 1911-13 in June to 53 per cent. above in July, this increase being mainly due to old potatoes being displaced by the new season's crop at a considerably higher price. The rise in the index number from this cause would have been greater but for decreases in the prices of fat stock.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

Wheat and oats were dearer by 4d. and 3d. per cwt. respectively than in June, but as these commodities usually advance in price at this season oats remain unchanged at 41 per cent. above pre-war while wheat has advanced one point. Barley was 3d. per cwt. cheaper in July, but owing to the average price in July of the years 1911-13 being higher than in June a fall of 5 points is recorded. The price of first early potatoes in July was nearly three times that of old main crop potatoes in June, and the index figure rose from 31 per cent. below the pre-war price to 66 per cent. above, as compared with 75 per cent. above in July, 1922. Hay was slightly cheaper in July, and with a decline of 4 points on the month was 38 per cent. above the average of July, 1911-13, or practically the same as in July of last year.

Fat cattle recorded a decline of 3d. per 14 lb. stone, this being relatively a much greater reduction than in the years 1911-13, and the increase of 45 per cent. above pre-war prices is 7 points lower than in the previous month. Fat pigs were in little demand during July owing to the exceptionally hot weather and prices declined sharply, the percentage increase over the pre-war years falling from 69 in June to 54 in July, a drop of nearly 25 per cent. since January last. Average prices of fat sheep declined further and were lower than at any time since January, 1922; the index number fell 11 points to 72 per cent. above 1911-13.

Dairy cows advanced slightly in price, but as the increase was relatively less than in 1911-13 the percentage increase has declined 1 point. All descriptions of store stock were cheaper than in June, store pigs showing the greatest reduction, the decline amounting to 17 points on the month, while store sheep and store cattle declined by 5 and 3 points respectively. Store sheep and store swine were, however, still more than twice as dear as before the war.

The average contract price of milk is unchanged in London as very little surplus milk has been forwarded, but prices in Birmingham and Manchester have advanced slightly, and the average over all has increased from 53 per cent. in June to 57 per cent. above 1911-13, or slightly more than in July, 1922. Butter advanced 1¼d. per lb., a relatively greater increase than in pre-war years, and at 37 per cent. for July was 4 points higher than in the preceding month. Eggs were also dearer, but as the increase in value was relatively less than before the war the index figure shows a reduction of 4 points on the month declining to 36 per cent. above the years 1911-13.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	July	Mar.	Apr.	May	June	July
Wheat ...	53	27	31	37	38	39
Barley ...	49	8	11	16	17	12
Oats	55	36	39	42	41	41
Fat cattle ...	70	54	51	53	52	45
Fat sheep ...	107	94	100	103	83	72
Fat pigs .	91	77	71	72	69	54
Dairy cows ...	64	58	55	50	50	49
Store cattle ...	39	31	29	33	31	28
Store sheep ...	108	92	92	98	114	109
Store pigs ...	115	136	131	126	130	113
Eggs... ...	80	55	37	43	40	36
Poultry ...	103	81	75	77	87	79
Milk	53	87	70	63	53	57
Butter ...	79	70	68	40	33	37
Cheese ...	50	95	92	42	44	54
Potatoes ...	75	—12*	—28*	—28*	—31*	66
Hay	37	42	40	41	42	38

* Decrease.

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AGRICULTURAL LANDOWNERS.

I.

THE RT. HON. LORD ERNLE, M.V.O.

The following pages are the substance of a Lecture on " Agricultural Landowners," given at the Summer Meeting of Vacation Students in the Examination Schools at Oxford on 9th August, 1923.

THE subject given me is that of Agricultural Landowners. It bristles with controversies which arouse many prejudices. But we can, for a few minutes, treat agricultural landowners as neither saints nor ogres, but as ordinary persons—neither better nor worse than ourselves.

Men are land animals. Their interest in land is therefore almost universal. Most people can conduct their business without attracting public attention. Not so the landowner. *His* business is always under observation, because it affects the business and life of everyone. At work, at play, at home, we cannot escape the landowner. The result is that for centuries questions affecting the ownership of land have been burning. To-day they are still ablaze.

It is a common impression that agricultural landowners have grown rich while others remain poor, or that they are only sleeping partners in the industry, mere recent-chargers on their estates—that, in fact, they are bloated parasites. Are they bloated? Are they parasites?

Stationary Character of Income from Farm Lands.—During the last hundred years agricultural landowners have not grown richer. In net income they have become very much poorer. The growth of the gross national income of Great Britain is in striking contrast with the stationary character of the gross income of agricultural landowners. The following figures are only illustrations of these two facts. Without a complicated discussion they cannot be made strictly comparable. In 1800 the gross national income of Great Britain, both exempt and liable to income tax, was estimated at £190,000,000. In 1922 it was similarly estimated at £2,600,000,000. Now look at the gross income in Great Britain from agricultural land, farms and farm buildings, tithes, manors, fines on leases, and some sporting rights, in 1814 and in 1922. The former year is taken in preference to 1800, because the area of cultivated land had then become, under war pressure and fear of famine, more approximately as large as it is now. In 1814 the gross income from agricultural land was 42½ millions; in 1922 it was 43½ millions, or practically the same. In 1814 it was rather more than one-fifth of the gross national income; in 1922 it was considerably less than one-fiftieth.

The stationary character of the gross income from agricultural land is the more remarkable, because, during this period. landowners have spent a vast amount of private capital on their estates. I am not considering the money spent in buying landed property, or even the money expended on the initial operations necessary to reclaim the land for cultivation. I am only speaking of the outlay of private capital in equipping the land with the farmhouses, farm buildings, cottages, fences (including gates and posts), drainage, water-supply, and farm roads, which are necessary to develop the productiveness of the soil. All this essential machinery of a farm is liable, like any other machinery, to wear and tear, and has to be kept in repair and renewed. The annual cost of this upkeep, including insurance and management. may be taken at a third of the gross rent.

Rents.—In a familiar often-quoted passage in his *Political Economy*, Mill points out that the rent of a farm includes two payments. One is payment for the use of the productive powers of the land; the other is payment of interest on the capital expended on that equipment which enables the farmer to use the land productively. The landlord, he says, is entitled to charge the ordinary interest on the value of the equipment, that is, he explains, on the cost of providing equipment as good as that then existing. It will be natural to expect that the payment of interest on capital, added to the payment for the use of the productive powers of the soil, would increase the gross income from agricultural land. It has not done so. The gross income has, as we have seen, remained stationary. What is the explanation?

It is the opinion of many experienced agriculturists that, after interest on capital at the low rate of 3½ per cent. has been paid, and the annual cost of upkeep has been met, all rent for the use of the land itself has been swept away by the fall in prices. The correctness of this opinion mainly depends on the amount of private capital which agricultural landowners have expended per acre on the existing equipment of the farms of this country.

This subject was discussed in 1907 with great care and ability by Mr. R. J. Thompson in a paper read before the Royal Statistical Society. He came to the conclusion that in 1900 the average expenditure of private capital on the existing equipment of farms was £12 an acre; that interest should be charged at 3½ per cent., then the current rate at which the Government borrowed; that 35 per cent. should be deducted from the gross rent for repairs, insurance and management; and that, on those figures, out of every pound of rent 4s. 6d. represented payment for the use of land. More recently the Land Agents Society in 1919 prepared a Return from the actual figures of capital outlay. It relates to 9,000 acres, divided into 27 farms of different sizes, belonging to different owners, in different parts of the country. It shows that £146,000 was spent on equipping 9,000 acres, or an average of £16 an acre. The average net return to the landowner, after deducting from the gross rent the necessary outgoings for repairs, insurance and management, was 3½ per cent. on his capital, and nothing at all for the use of the productive powers of the land.

Neither of these inquiries fully reveals the true condition of affairs. The outlay on a farm varies to some extent with the purpose to which the land is put. A purely grazing farm, for instance, requires least expenditure. Still more important is the variation in outlay per acre caused by the different sizes of farms. £1,000 laid out on a 30-acre farm is £33 an acre; £2,000 spent on a 100-acre farm is £20 an acre: £7,000 spent on a 1,000-acre farm is £7 an acre. Practically all the figures quoted by Mr. Thompson relate to farms over 300 acres. In the Return of 1919 ten of the 27 farms exceed the 300-acre limit. But in actual fact, on the pre-war figures, out of the 435,886 holdings of England and Wales, 421,314 are holdings of 300 acres or under, and 14,572 are farms above 300 acres. That is to say, 96 per cent. of the farms belong to the type in which equipment is most expensive; only 4 per cent. are of the type which it is cheapest to equip. The average expenditure per acre is unduly lowered by the disproportionate number of examples of large farms on which both Mr. Thompson and the Return rely. Based on the actual sizes of holdings, the average outlay cannot be put at less than £20 per acre. If this is so, landowners may receive interest at 3½ per cent. on their capital outlay on equipment, and the cost of its upkeep, but nothing is paid for the use of the productive powers of the land.

Our system of agricultural landowner and tenant thus operates as a method of cheap agricultural credit, founded, not on State aid, but entirely on private capital. A lease is practically a loan of land equipped for cultivation at a low average rate of interest on the capital expended in equipment. The farmer, who as tenant accepts the loan, is thus set free to use his own capital for the cultivation of the soil. The provision of the capital, running into several hundred million pounds, on which this system of cheap agricultural credit is founded, is one of the benefits which agricultural landowners confer on agriculture.

Landowners' Example a Lead to Advance.—Nor is it only their capital that agricultural landowners have contributed to the progress of the industry. They have by their example given a lead to advance. Medieval barons were indeed rarely interested in farming. War, military exercises and the chase were their chief occupations. There were exceptions. Edward II was a breeder of horses and an expert thatcher. An Earl of Berkeley, at or about the same time, is said to have attended all the markets of his neighbourhood with samples of his own corn, and fumbled in the recesses of his armour for his leathern bags of wheat, barley, or oats. But the foot of the lay owner rarely fatted the soil. The best farmers were the Churchmen, especially the monks. Two of the earliest treatises on farming were written in Norman French in the thirteenth century, one by a Bishop of Lincoln, another by a Dominican Friar. But the first English book was written by a Derbyshire landowner. In 1523 John Fitzherbert put his 40 years' experience into a Book of Husbandry which remained for more than a century the best and most practical work on English farming.

From the thirteenth century to the middle of the eighteenth. there was little general improvement in agriculture. If a steward of a manor in the reign of Henry III had visited a village farm in the days of George II, he would have found the same methods, the same implements, the same limited range of crops, the same quality of live stock. Probably he would have thought the farming more slovenly, and lamented the abandonment of more than one useful practice. Yet a number of new sources of agricultural wealth had been accumulated and tested by landowners. They had, in fact, collected the material and means for a proper rotation of varied cropping; they had also solved the problem of providing winter keep for live stock, and of supplying the country with fresh meat at Christmas instead of the smoked and salted beef or mutton which were formerly the staple diet of the nation.

In both the great periods of agricultural progress—1760-1820, and 1853-74—landowners gave the lead. In the first, they were pioneers of improved practices; in the second, they were the readiest to adopt the discoveries of science. It was the union of practice with science, which in the "seventies" made English farming the model for foreign nations, and founded the world-wide reputation of English live stock.

In the disastrous period of the last 20 years of the nineteenth century, landowners also proved their value. They bore their full share of adversity. They saved thousands of farmers from bankruptcy, nursed them through bad times, and crippled themselves in the process. Few have now the means to help in the same way or to the same extent. Heavy taxation, pressing hardly on stationary gross incomes, has completed the impoverishment which the fall in prices began.

To have created an efficient system of agricultural credit, to have been leaders in progress and mainstays in adversity are achievements which can be fairly credited to agricultural landowners. No doubt their self-interest was a spur. But it is unreasonable to deny them a mixture of more generous motives. During the last century, the net income from agricultural land has dwindled, as compared with the increased financial resources of other classes in the country, enormously. This fact has a bearing on some of the charges often made against agricultural landowners in the administration of their estates.

The Charge of Hostility to Small Holdings.—One charge is that landowners are hostile to small holdings. Technically, holdings of from one acre to fifty acres are included in this class. Before the War, out of the 435,886 farmers in England and Wales 292,000 were small holders. More than 66 per cent. of the farms in England and Wales are of this size; less than 34 per cent. are above. This very considerable proportion of small holdings does not confirm the charge of general hostility. That agricultural landowners are cautious in creating them is true. They know that certain conditions both in the holding and the holder are essential to success. If all these conditions are present, a man who has an average share of good weather and stable prices ought to succeed. If any of the conditions are absent, or if the man has a run of bad seasons and irregular prices, he is almost certain to fail.

In the small holder's interest landowners are cautious. They are cautious also in their own. It is a matter of business. Unless they charge a very high rent, they lose money. The land must be good in quality and convenient of access to roads and markets. Often it is the very piece which lets a considerable area of moderate and indifferent land. Suppose that a landowner desires to create a small holding of 30 acres consisting of some of the best land on a farm of 200 acres, let at £1 an acre all round. The tenant naturally asks a reduction of rent on the area which is left to him. The eye, as he says, has been picked out of his farm. The landowner is lucky if he escapes with a loss of £40 in rent. Can he recover it out of the small holding? In most cases he cannot. At present prices, the equipment of a small holding of 30 acres will cost £1,000, or £33 an acre. Assume that the rent is 30s. an acre, that is £45. From the gross rent must be deducted one-third for the upkeep. The net rent is therefore £30, or only 3 per cent. on the capital outlay and nothing for the land. The result is that the tenant-farmer is disgruntled and unsettled; that the small holder is aggrieved because he pays 10s. an acre more than the farmer over the hedge; and that, finally, the landowner is £10 a year out of pocket.

The Charge of Wasting Land.—Another charge is that of wasting land, firstly, by neglect to improve, and secondly, by excessive preservation of game. The total area of land in England and Wales to high-water mark, but excluding the acreage covered by lakes, rivers and canals, is 37,136,626 acres. The cultivated area under crops and grass, excluding gardens, is 26,025,000 acres. The area of commons, mountain, heath, moor, and other rough land used for grazing, amounts to 4,781,000 acres. Forests, woods and plantations occupy 1,884,000 acres. The remaining 4,445,000 acres are accounted for by buildings, gardens, railways, roads, and mountains and wastes not available for grazing. It is in the 4¾ million acres of rough grazing that land is to be found which might be added to cultivation. Probably between 100,000 and 250,000 acres could be thus reclaimed. If expense were no consideration the area might be half a million acres.

In bringing land into cultivation there are two processes, each requiring some outlay of capital. The first is its preparation. Roots, for instance, have to be grubbed and stones removed; the land must be broken up, ploughed and probably marled: a portion must be sown for meadow or pasture. Almost all the cultivated land of the country has undergone this initial process. But the preparation took place too long ago to be taken into account in estimating the present capital outlay. Now, however, when the question is the expense of bringing new land into cultivation, it must be taken into account. It cannot be put at less than £5 an acre. To this must be added the cost of equipment—that is to say, the farmhouse and outbuildings, the cottages, the fencing, including the gates and posts, the drainage, the water-supply, the farm-roads. What this will cost per acre largely depends on the size of the farms into which the newly reclaimed land is divided. Suppose that a landowner decides to reclaim a thousand acres of rough grazing, let at 1s. an acre, or £50 a year, and to do it as cheaply as possible. The initial cost of preparation is £5 an acre, or £5,000. At pre-war prices the cost of equipment for a thousand-acre farm cannot be put at less than £7,000, or £7 an acre. The capital outlay is therefore £12,000. Probably there will be no rent at all for several years. But assume that 12s. 6d. an acre is obtained from the first, or a gross rent of £625. From the gross rent must be deducted one-third for upkeep, insurance and management, say, £205. The net rent is therefore £420. But the landowner has lost the £50 a year rent for his rough grazing. He therefore only reecives £370 a year on the transaction. If, as is almost certain, he has had to borrow the capital of £12,000, he pays for the loan at 5 per cent. interest £600 a year, and he receives from his new investment a net return of £370 a year. He loses £230 a year.

Go one step further, and suppose that the landowner is an enthusiast for small holdings, does what, on social grounds, we should all desire him to do, and lays out his thousand acres in 33 small holdings of 30 acres each. The initial cost of preparation is the same—£5,000; the equipment of the 33 holdings at £1,000 apiece is £33,000—making a total capital outlay of £38,000. At the best it is moderate land. Assume that the landowner lets at 25s. an acre, and gets it from the first. His gross rent is £1,250. From this has to be deducted the one-third for upkeep, say, £412. With 33 sets of farm buildings the cost of upkeep might probably be more. But that point may be waived. His net rent is therefore £838, or, if we deduct the £50 rent for rough grazing which he has lost, £788. But he has borrowed £38,000 at 5 per cent. He pays for his loan £1,900 a year, and receives from his new investment a net £788 a year In other words he loses £1,112 a year. Comparatively poor men must set some limits to their philanthropy.

It is also said that agricultural landowners waste land and diminish food production by excessive preservation of winged game. That damage may be done to crops by winged game is not denied. and, where preservation is carried to excess, it is a real evil. But even in pre-War days, the damage done was perhaps neither so great nor so general, as has been represented.

Bad farming often sheltered itself behind the alleged depredations of the pheasant. Nor does it seem, at first sight, probable that land which was worth cultivating was ever withdrawn from food production. Landowners are rarely rich enough to sacrifice a farming rent, however small, for a sporting rent of from 1s. to 3s. per acre.

Less bitterness against game preservation would be aroused, if landowners exercised their sporting rights themselves and did not let them to shooting tenants or syndicates. It is not merely that agricultural landowners themselves rarely preserve to excess, either from want of money, or respect for public opinion, or regard for their tenants. It is the intrusion of the commercial element into sport—the letting to strangers and the sale of the game—which chiefly outrages public opinion. Yet even this commercial element has advantages to the countryside. Many landowners can only afford to live in their country houses by the help of sporting rents. In other cases the sporting rights secure tenants for country houses that would otherwise stand empty. Those who live in the country know the loss to the whole neighbourhood when the big house is unoccupied. There is loss of employment and wages, loss of practice to professional men, loss of custom to local tradesmen, loss to the ratepayers of the rateable value of the empty house which must be made good elsewhere. There is loss also to farmers, for the rent of the house and the sporting rights often enable the landowner to maintain the efficient equipment of the farms which otherwise would deteriorate. Even if the house remains unoccupied, and only the sporting rights are let to shooting tenants, there are still advantages. Some of the money may go to the upkeep of the estate; keepers are employed who otherwise might be out of work; beaters earn money at a time when cash is scarce in rural districts. And sporting rights, thus severed and let, are a valuable rateable asset which diminishes the general burden of ratepayers. They pay the full and not the special agricultural rate; added to the rateable value of woodlands in their natural unimproved state, the rents substantially increase the assessment, and help to reduce the burden of the rates to everyone else.

(To be concluded.)

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POINTS OF THE HORSE.

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IT is not the intention to discuss, in this article, the points of the various breeds of horses, but rather to try to define the good and bad points which may be seen in all classes of horses. In the space available we cannot hope to deal fully with a subject on which volumes have been written, but must confine our remarks to what seem to be the more important points. It is proposed to recognise only two types, the light (speed) horse, and the heavy (slow) draught horse, pointing out the few instances in which these two classès ought to differ.

To a great extent the economic value of a horse will depend on his durability, on his capacity to undergo severe strains in the work he has to do, whether in his speed-work, or in the moving of heavy loads, without breaking down and becoming useless for further work.

This durability will depend on his breeding or quality, on his conformation, and on his action. To judge these points correctly needs close observation and constant practice, and also some knowledge of the structure of the animal's body is useful. Many good judges seem to know intuitively what is the best shape, and do so without any knowledge of anatomy, but the man who has this knowledge will become proficient in a much shorter time.

The Framework.—The horse's framework or skeleton is composed of a large number of bones connected by cartilage and ligaments. Attached to the bones are the muscles which supply the motive power under the control of the nervous system. The bones form three classes of levers, to which the muscles supply the power and the joints form the fulcra. Many muscles act on distant parts of the framework, to which they are attached by long tendons or sinews. This arrangement gives lightness and elegance to the lower part of the extremities.

To a considerable extent the bones of the skeleton give shape to the body, but not entirely so: for example, in the neck the shape depends on the muscular development. If we compare a living animal with an illustration of the skeleton (A) this fact is at once seen to be true. Again, the hind-quarters have a bony framework, but their shape largely depends upon the great muscles covering the bones of this region.

A glance at a well-developed horse will show a marked difference in the muscular development of the hind extremities compared with the fore extremities.

The hind limbs supply the propelling power, which enables a draught horse to move a heavy load, a hunter to fling himself (and his rider) over a high or a wide obstacle, and a race-horse to travel at high speed. To do this, the muscular development of the hind parts must be great, while the fore extremities, having only to support the weight of the body (of which they seem to carry more than a fair share), take but a small part in propulsion. For this work the fore limbs need far less muscular power. If we assume that the hind legs support the weight of the posterior half of the trunk, it will be seen that, in addition to carrying the anterior part, the fore limbs have to support the long neck, to the end of which is attached a heavy head. These facts are borne out by the greater muscular development of the hind extremities, and also by the very different modes of attachment to the trunk of the fore and hind extremities.

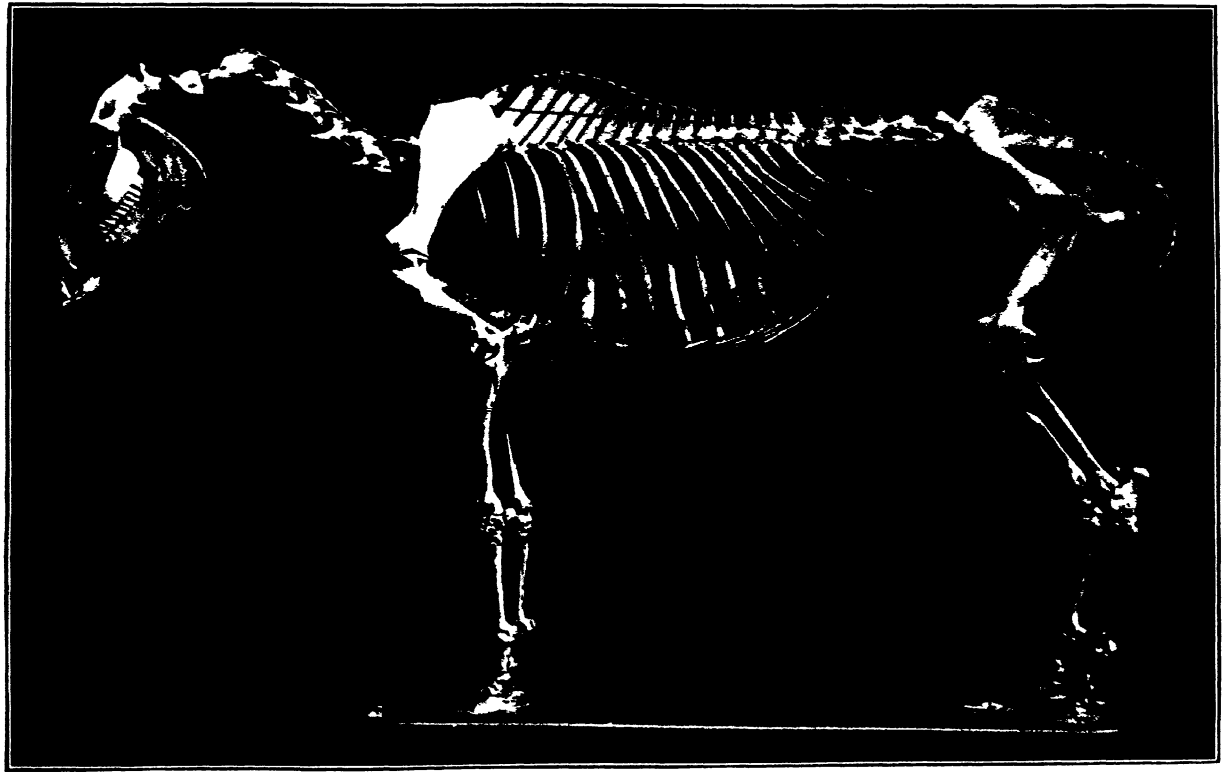
In the latter, the top bones of the limbs, the ossa innominata or pelvic bones, are firmly attached by a fixed joint, to the back bone in the sacral region. An examination of the skeleton will show how carefully nature has provided for firmness and strength in this region to withstand the enormous strain when pulling a load, or leaping or galloping.

When we examine the fore-extremity we notice the absence of the great powerful muscles supplied to the hind extremity, and we find that the fore-limb is only attached to the front part of the trunk by muscles, and that there is no fixed immovable joint like that in the hind leg. If we stand in front of the horse and direct our attention to the anterior part of the trunk, we see that it is placed between the shoulders, to which it is attached by muscles, which suspend it (the trunk) as a man's body is supported in a hammock.

These anatomical facts confirm the view that the hind limbs are used for propulsion, while the fore-limbs chiefly support the weight of the body.

The fact that the fore-legs have to support so much weight will explain the reason why they wear out more quickly than the hind parts do.

In carrying a man in the saddle it has been estimated that the horse's fore-legs take 66 per cent. and the hind-legs only 34 per cent. of the man's whole weight. In going downhill



A —Skeleton of Horse

a still greater portion of the weight will be thrown on the fore-legs.

The movements of the limbs in walking, trotting, galloping, etc., are exceedingly complex, and are brought about by different groups of muscles, contracting and relaxing in proper sequence, and all working together harmoniously. This co-ordination of the various groups of muscles, taking part in any movement, is fortunately not controlled by the animal's will, but is regulated by a special part of the brain (cerebellum) set apart for this work.

Before dealing with quality, shape and action, it is necessary to mention the lubricating system of the body, by which the movements of the limbs are made smooth and easy. Each joint is surrounded by a capsular ligament forming a bag enclosing the ends of the bones. This bag is lined by a synovial membrane which secretes the lubricating fluid, synovia or joint oil. Wherever a tendon plays over a bone, or through a fibrous sheath, synovial membranes are arranged to provide the lubricating fluid and so to prevent friction. Without this lubricating system, the rapid movements of the limbs would soon become impossible, and the wearing parts would be quickly destroyed by friction.

Quality or Breeding.—Horses show their breeding in their bones, skin and hair. The bones of a well-bred horse are denser, harder, more ivory-like, than those of an under-bred animal, in which they are found to be softer, more spongy, and far less durable.

The skin should be thin and elastic and covered with fine soft hair, and in those heavy breeds in which long hair or "feather" grows on the lower part of the legs, it should be fine, straight and silky, not coarse or inclined to curl. A coarse thick skin and coarse thick hair in a draught horse will indicate want of breeding and point to bone of a poor quality.

Horses, however, also show quality in the size and shape of the head. It has been written (The Druid): "Had I to choose a hunter by seeing one point only, it should be his head, for I never knew one with a small clean intelligent face and prominent eyes to be bad" (B. See illustration.)

Horses of all classes show their quality by their heads, which should be small, wide across the forehead, with large kindly eyes (a sign also of good temper), small pointed ears, a wide space between the outer corner of the eye and the angle of the lower jaw, large open nostrils, and plenty of space between the branches of the bottom jaw to give room for the upper part of the windpipe (larynx). The nostrils must be thin and flexible and capable of great distension. The horse is unable to breathe through his mouth owing to the great length of the hanging soft palate, and he therefore needs to have nostrils capable of distension to admit sufficient air during exertion.

In the low-bred horse the head is large and coarse and unshapely, with large ears, a narrow forehead and small eyes and nostrils.

Quality and good breeding denote endurance. Dick Christian has said, in speaking of the thoroughbred hunter: "I never heard of a great thing yet, but it was done by a thoroughbred horse."

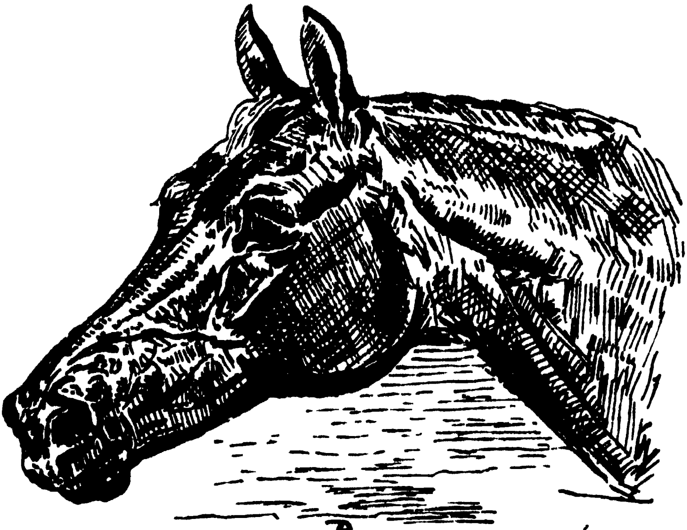
Breeding tells, and it is wise for the horseman to look for these indications of quality in whatever class of horse he requires.

Conformation.—As indicated above the horse's locomotor apparatus contains a highly organised collection of bones and joints, muscles and tendons, and an intricate set of levers, all working harmoniously together, without waste of power and without undue friction.

This harmony will depend greatly on the true shape of the body and limbs, and it must now be our task to show what is to be regarded as the correct conformation. It is necessary first to take a general survey of the animal as a whole before making any detailed examination of the several parts, head, neck, trunk and limbs.

When viewed from a short distance the well-proportioned horse should deceive the eye: he should seem much smaller than he afterwards proves to be on closer acquaintance. The most remarkable instance of this, in our experience, occurred when inspecting a high-priced weight-carrying hunter. When the door of the loose-box was opened our first impression was that we were looking at a "mere cob," but on standing at his shoulder the "mere cob" proved to be over seventeen hands high! This deceptive appearance is an excellent point in a horse's favour.

The Head.—Still standing at a distance the shape of the head should be noted, and the way it is attached to the neck. The head should be carried gracefully and should move freely on the neck without fullness or heaviness at the junction of head and neck (B).



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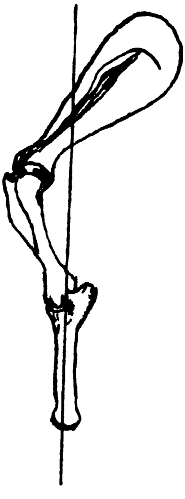

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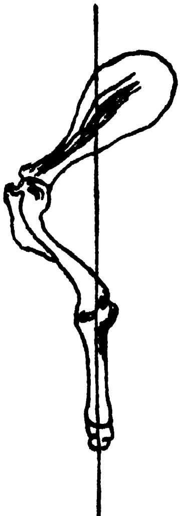

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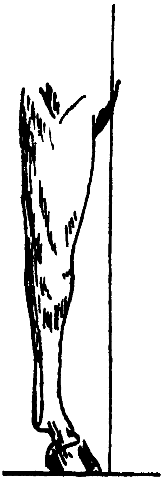

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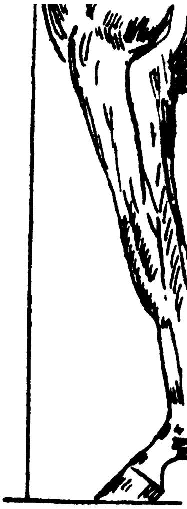

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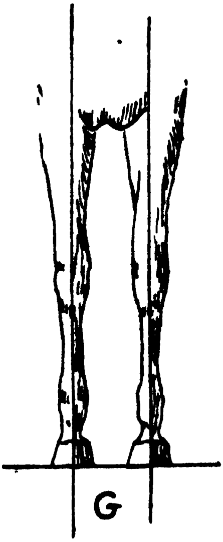

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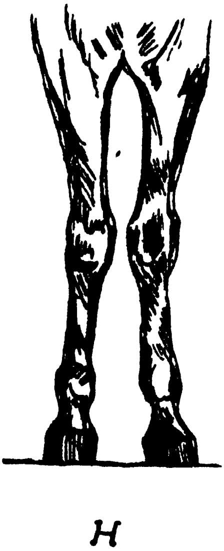

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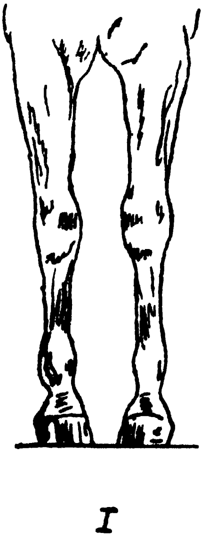

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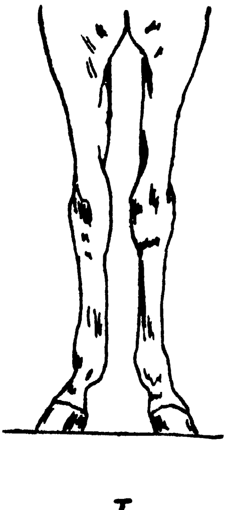

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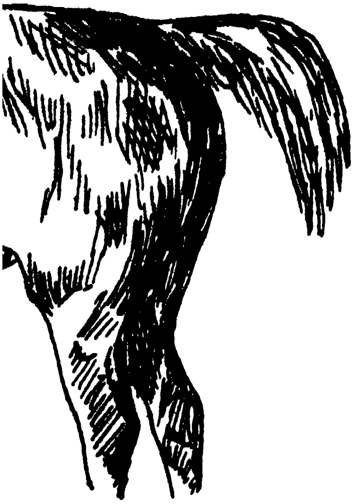

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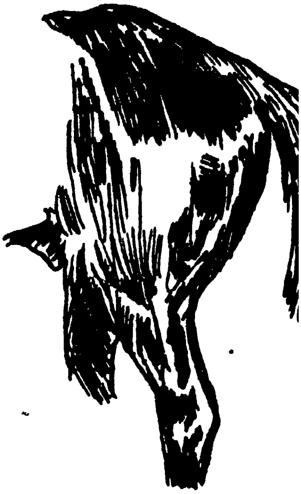

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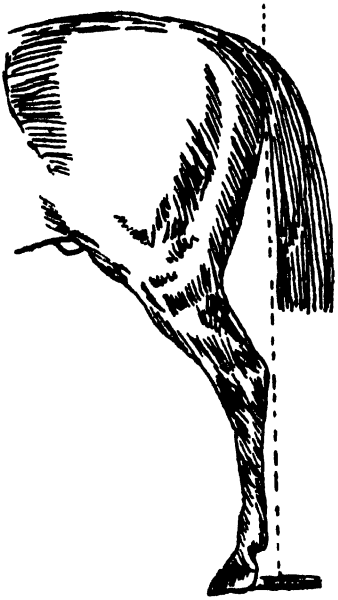

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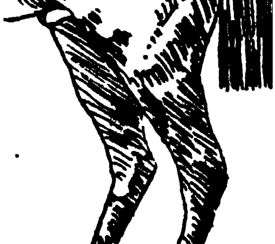

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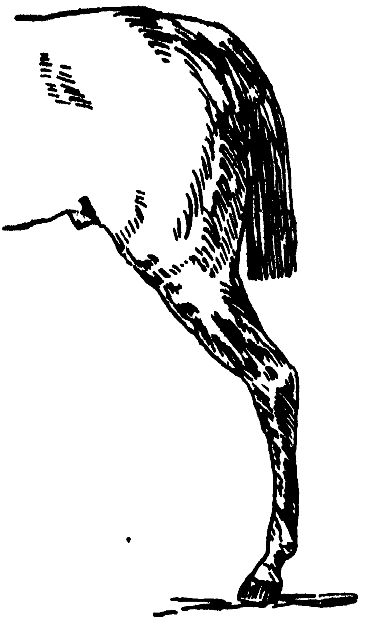

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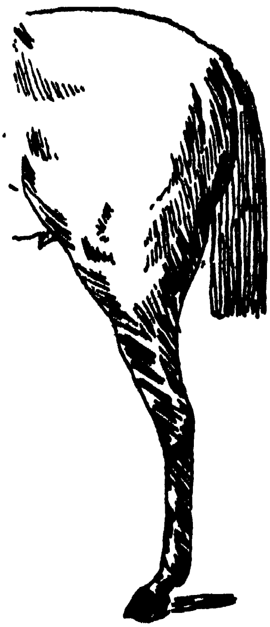

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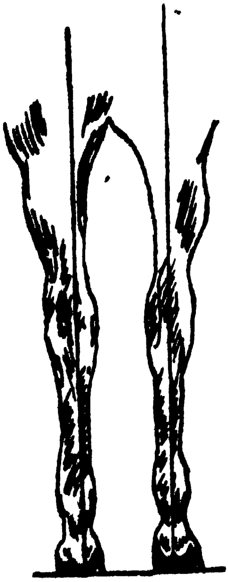

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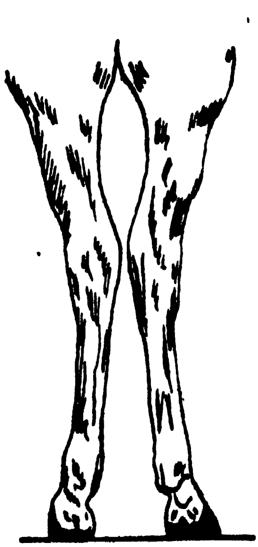

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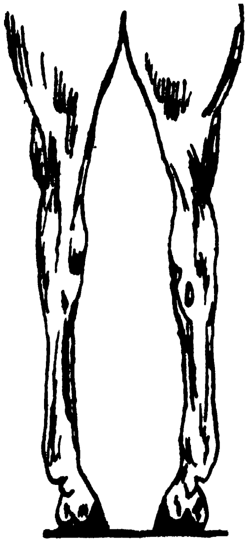

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The neck should be sufficiently long and muscular, with a well defined wind-pipe in front, and nicely arched at its upper border, and *without* a heavy crest. The crest is formed by a mass of fat surrounding the long elastic ligament of the neck, which helps to support the weight of the head. A thick heavy crest only adds to the weight to be carried by the fore-legs.

In the draught horse the neck should be muscular, of medium length and thickness, and unencumbered with fat.

In all classes the ewe-neck with the badly set-on head is to be avoided.

The chest, seen from the front, should be narrow in the light speed horse, but broad and muscular for the heavy draught horse. The space between the fore-legs in the former, should allow the open hand to lie easily under the breast bone, but in the latter the breast needs to be wide and well muscled, and the fore-legs sufficiently separated. Again, viewed from the side the chest should be deep from above downwards rather than broad from side to side. The deep oval chest gives a better girth and a greater lung capacity than the broad round chest. Also the deep chest gives freer play for the shoulders, and is evidence of good staying power. A broad chest, with too much space between the fore-legs, renders free smooth action impossible.

In the speed horse the neck seems to blend imperceptibly with the shoulder, but in the draught horse there is a sufficiently deep hollow at the junction of neck and shoulder into which the collar may fit comfortably.

The ribs behind the shoulders should be sufficiently arched to form an oval chest, and the posterior ribs should be sufficiently long to prevent an appearance of "lightness in the flank." The last rib should be about a hand's breadth in front of the hip bone to give a "well-ribbed up" appearance. This shortness of the space between the last rib and the hip bone may be due, either to the presence of an extra or "floating" rib, or to the loin region containing only five vertebræ.

Where a horse is "badly-ribbed up" there is no floating rib, and the number of lumbar vertebræ is often increased to six instead of five.

The "well-ribbed up" horse is generally a good doer, while the "badly-ribbed up" animal is often a delicate feeder, difficult to keep in good condition and very liable to scour.

The Withers.—Turning our attention next to the upper line of the body, the withers should be prominent and should rise up well above the shoulder blades. The withers should be thin in the speed horse, but much thicker and more muscular in the draught horse. Low withers are inadmissible except in the immature animal. The withers are formed by the long superior spinous processes or projections of the first few dorsal vertebræ, and the further back the long processes extend the shorter the back will appear. Between the withers and the croup the spinous processes are all of equal length.

The Back.—Although anatomically the withers are part of the dorsal region or back, the horseman recognises two regions, first the withers, then the back. The back should be straight. A hollow back must be regarded as a sign of weakness. In all old horses, there is a tendency for the back to become hollow. The muscles on either side of the back-bone should be well developed and fill up the angle between the ribs and the vertebræ.

The loins lie between the back and the croup and are formed by the lumbar vertebræ, five or six in number. When six bones are present the loins appear too long, unless well covered with muscle, and the space between the last rib and the hip bone too wide. The loins should be broad, muscular and flat, and should continue the line of the back towards the croup. If the line rises from the back to the croup the horse will have a "roach-backed" appearance. It is important that the upper line of the body from the withers to the croup should give an impression of shortness when compared with the under line from the elbow to the stifle.

Although *the quarters* belong to the hind extremities. it is convenient here to continue the survey of the upper line backwards to the buttocks. The quarters should be well shaped and pleasing to the eye, the central line being slightly convex. The hip bones should be wide, but not sufficiently prominent to warrant the term "ragged." The tail should be set on "high" and be carried with distinction (K). We shall refer again to the quarters in describing the hind extremities.

The Under Line.—Turning our attention to the under line of the body, when the shoulders are good, the chest deep and and the posterior ribs of sufficient length, the under line will appear long, and nearly parallel with the surface of the ground, and the horse is said to "stand over a lot of ground." The horse with upright shoulders, badly placed fore-legs, and a round barrel, will look "leggy" and show a "lot of daylight under him."

In the majority of horses the length from the point of the shoulder to the buttock is about equal to the height at the withers, so that the body and limbs (excluding the neck and head) form a square. This rule will hold good for the "long low" horse as well as for the "leggy" looking animal with a "lot of daylight under him."

The reason for this different appearance is that the former has good oblique shoulders, a short back and a long under line; in the latter the shoulders are upright, making the back look longer, while the under line is defective owing to the backward position of the fore-legs, the shortness of the posterior ribs and the long space between the last rib and the hip bone. It is the true conformation of the body which is deceptive making the top line appear short and giving the under line length, but when the shape is wrong the opposite effect is produced, a long back and a short under line producing a high "leggy" appearance. If two horses were measured for length and height, although one looked "long and low" and the other "leggy and light in the barrel," they would both be found to approximate the squareness of the body and limbs mentioned above.

The Fore Limbs.—Next, viewing the fore-leg from the side, we should find a long oblique shoulder-blade, sloping upwards and backwards from the shoulder-joint. This appearance of a good sloping shoulder is aided by the correct position of the second bone, the humerus, which should form a wide angle with the scapula, and should be placed in a more or less perpendicular position between the shoulder-joint and the elbow (C). This brings the fore-arms and knees well forward and adds to the length of the under line of the body.

If, however, the humerus is more horizontally placed (D) the fore-arm and knee will be more backward under the body, and will give a shorter under line. This latter position of the humerus goes with upright shoulders, while the more perpendicular humerus is seen with the good sloping shoulder. Well-shaped shoulders are essential in all classes of horses, giving smooth free action to the fore-limbs, but in the draught horse some authorities maintain that a more upright shoulder is not only admissible, but even an advantage in giving greater power in collar work. This may be true, but to-day a well-made draught horse is expected to be capable not only of walking well, but of trotting with good free action, and for this the sloping shoulder is essential. The shoulder-blade should be well covered with muscle in the speed horse, and still more so in the heavy horse.

To test the obliquity of the shoulder, an imaginary line may be drawn upwards from the centre of the fore-arm and should pass just behind the shoulder-joint, so that the major portion of the scapula is behind such a perpendicular line (C). The large and powerful muscle which fills the angle formed by the scapula and humerus should be well developed, plump and firm.

The fore-arm, between the elbow and the knee, should be long, broad and muscular above, but narrowing towards the knee. A weak thin fore-arm is a great disadvantage in both speed and draught horses. The knee should be large, flat in front, but with a strong projection at the back formed by a bone, the trapezium. This bone gives attachment to important muscles of the fore-arm, and also forms a groove between it and the main part of the joint, through which pass two of the flexor tendons. If the trapezium is small and placed too close to the main joint, the tendons have not sufficient room for free play and are cramped in their action. Below the knee, the cannon bone should be short and strong, and the leg broad from front to back. This will give the necessary "good girth" below the knee, and the "flatness of bone" as it is termed in horseman's parlance. The width of the leg below the knee depends upon the position of the three back-sinews which pass down behind the cannon bone. These three sinews should be clearly defined and stand out well from the cannon bone, and from each other. It is *this* which gives "good girth" and "flatness" so much praised. When the back sinews are packed closely to one another and to the back of the cannon bone, the leg feels round instead of flat, the girth is small, and there is a "tied in" appearance below the knee. Although "flatness of bone" below the knee is often spoken of, the term is incorrect, as the cannon bone is oval from side to side and narrowest from front to back, and cannot give an appearance of "flat bone," which is due, as stated above, to the position of the back-sinews in relation to the cannon bone.

The fetlock should be sufficiently large and strong, with well-developed sessamoid bones at the back. These two small bones are attached behind the cannon bone at its lower end, and together form a groove over which two flexor tendons play freely.

From the fetlock, the pastern slopes downwards and forwards to meet the hoof at the coronet. This slope of the pastern varies considerably in different horses, but should always correspond to the slope of the front of the hoof, to which it should be parallel.

The hoof should slope upwards and backwards to the coronet at an angle of about 55°, and the slope at the heels should be parallel to that at the toe, and the heels about half the height of the front of the hoof. One frequently reads the absurd statement that the proper slope of the front of the hoof is at an angle of 45°. A single glance at a drawing of a hoof at this angle will show its impossibility. On raising the foot and examining its under surface, it should be almost circular in shape, with wide open heels, a concave sole and a good strong frog. There is nothing more true than the old saying, "no foot, no horse." However good his other parts may be, a horse will be of little economic value if his feet are faulty.

Lastly, before viewing the fore-legs from the front we should drop an imaginary line from the point of the shoulder to the ground (E). If the leg is properly placed and well shaped, the line should touch the ground slightly in front of the toe. In a horse with the "knees back" the line will fall several inches in front of the toe (F). In viewing the fore-legs from the front the fore-arms should be long and muscular, the knees broad and strong, and the fetlocks large and well developed. Large joints, in proper proportion to a horse's build, will give a distribution of the weight over a larger surface, and will also give promise of well-developed muscles and stout tendons.

The fore-legs should be perfectly straight, so that an imaginary line, drawn from the centre of the fore-arm (front) to the ground, should divide the knee, cannon bone, fetlock, pastern and hoof into two equal parts (G). Very many horses do not come up to this standard, some being "calf-kneed" (H), others "pentoed" (I), while many have legs turned out from the fetlock (J). Horses having such defects cannot have true action and will not be durable.

Hind Limbs.—Next, turning our attention to the hind extremity as seen from the side, the quarters should be well shaped and lengthy from the croup to the buttocks (K). The shape of the quarters depends partly on the bones forming the pelvic cavity and partly on the great muscles clothing the bones. The sacral vertebræ, which follow after the loin bones, form the roof of this cavity, and should continue in almost the same horizontal line as that of the back and loin, and the first tail bones, which come after the sacrum should continue the line backwards. In such long level quarters the tail will be "set on high up," but where the sacrum and early tail bones droop downwards the quarters will have the shape known as "goose-rumped," and the tail will be "set on low down" (L). Many goose-rumped horses, however, make excellent hunters.

The muscular development of the quarters and thighs should be good and in keeping with the conformation of the fore-hand. Too much muscle behind with a light fore-hand is not good.

The thigh bone (femur) slopes downwards and forwards from the hip joint to the stifle, and should be well covered with powerful muscles. From the stifle to the hock the bone (tibia) slopes downwards and backwards. This part of the limb corresponds to the fore-arm and should be long and muscular. Length of the gaskin and fore-arm is essential, while the parts below the hock and knee need to be short.

The hock (tarsus or ankle) is perhaps the most important joint in the limbs. It should be strongly built, with a good length of the bone at the back forming the point of the hock (calcis). To the calcis are attached tendons belonging to the powerful muscles of the back of the tibia, and other tendons also play over this bone in passing down the leg to the foot. The main hock-joint, in which there is the greatest movement, is between the end of the tibia and a bone of the hock known as the astragalus. The articulatory ridges on this bone run downwards and forwards and outwards and play an important part in the action of both hock and stifle. Sir F. Smith, in writing of the hock, attributes the "well-marked stifle action, particularly well seen in trotters" to the screw-like action produced by the astragalus. In addition to the main joint there are three minor joints in which the movement is slight and gliding. When viewed sideways the hock should be broad both above and below, and the point of the hock (os calcis) should stand out prominently, and well clear of the lower end of the tibia. On looking at the hock from the front it should have a bold clearly-defined outline, and on the inner surface the small bones forming the gliding joints should be strongly developed, and we should be able to feel, between the bones, the three grooves which mark the position of the minor joints. A weak hock is broad above but small and narrow at its lower part, from whatever point it is viewed.

An imaginary line dropped from the buttock should touch the point of the hock and the posterior margin of the leg, as far as the fetlock and then drop to the ground (M). If the hock is too much curved ("sickle-hock"), the line will touch the point of the hock but no other part of the leg (N). If the leg inclines backwards from the hock, the same line will strike the ground near to the toe (O). If the hock is too straight (P) it will be more likely to be injured by concussion, and in the straight hock the os calcis has a cramped appearance. Below the hock the limb follows the same conformation as the fore-leg below the knee, but the pastern and hoof are more upright, and the hoof is longer from toe to heel, is oval in shape, and has a more deeply-concave sole.

When seen from behind, the quarters should be equal both in regard to the position of the hips and in muscular development; any inequality denotes some defect. The muscles clothing the inside of the thigh should be plump and firm and round. Any deficiency of muscle here will give a "split up" appearance between the thighs.

The hind legs should be straight (Q) with the hocks neither too close together, nor too wide apart, and should not turn outwards from the hocks (cow-hocked) (R), nor turn inwards (pentoed) (S).

Action.—Good action generally depends on good conformation, and a badly-shaped horse cannot be a good mover.

To judge action the observer should see the horse move at the walk, trot and gallop (if the horse is to be used for work at this pace) both going away and coming towards him and also in passing. In passing it will be seen whether the horse has well-balanced equal action before and behind. The walk should be light and active, and the feet lifted high enough to clear any ordinary inequalities in the road surface. The fore-legs should be extended well forwards before the feet touch the ground and the hind-legs must be brought well under the body so that the hind-hoofs at least cover the impressions made by the fore-hoofs.

A good active walker will usually have good action in all his paces, while a shuffling, clumsy, heavy walker will not. In the walk, the fore and hind-legs should be carried directly forward in a straight line, without any faults such as "dishing" in front, or "twisting" the hocks outwards and the toes inwards.

In the trot the hind-legs must be carried well forward under the body, and the fore-legs carried equally to the front, without too much knee action, but in any case the action before and behind should be equal and well balanced.

High knee action with indifferent hock action is often seen, but is very faulty.

From an economic point of view, excessively high action must be condemned, however beautiful it may look in the show ring or in the park. Such action causes too much concussion and rapid wear of the limbs. A moderate all-round action is preferable, as more durable. In the trot, as in the walk, the action should be straightforward, without any "dishing" in front or "twisting" behind. In the gallop the action should be free, smooth and low, and without any high jerky bounding movement such as may be seen in a horse that is not a galloper.

In the true galloper the impression conveyed to the observer is that of a beautiful, well-oiled piece of machinery, working with faultless smoothness and precision, and at high speed.

True action means that the work is done without loss of power and with the minimum of effort, and consequently with the least amount of wear and tear.

Acknowledgments :—Badminton Library ; Smith's Veterinary Physiology ; Hayes, Points of the Horse ; The Veterinary Adviser, Leighton ; Horses and Stables, Fitz-Wygram ; Judging Livestock, Craig ; Journal of Royal Agricultural Society.

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PIG-KEEPING.

I.

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The Farmer's Aim—Pork, Bacon; Scale of Business; Capital Required; General Management; Breeding of Pedigree Pigs; Duties of the Pigman; Breeds, and Suitability for the Particular Business adopted; Pure v. Cross-bred Pigs.

IN 1922 the pig population of England and Wales was returned as 2,298,936; in 1872 the number was 2,586,000. In the intervening 50 years the demand for pig products in this country had steadily increased, but this demand was not accompanied by a corresponding increase in the numbers of our pigs, with the result that our imports of bacon rose from 2,001,855 cwt. in 1872 to 5,932,152 cwt. in 1922. Imports of hams, lard and pork showed similar advances. The imports figure for pork in 1922 was 757,606 cwt., while the total weight of pig products imported in 1922 was 10,422,320 cwt., representing a value of £55,306,027.

In 1881, Denmark's pig population was just over 500,000; at present the figure is in the neighbourhood of five times this number. While those engaged in British agriculture failed to keep pace with the growing demand for the products of the pig, Danish agriculturists and bacon curers set themselves the task of finding out exactly what the British consumer wanted in the way of bacon, and having learned this, they then proceeded to cater for the British market. The result is that to-day Danish bacon holds a strong position in the favour of the British housewife, and although it should not be impossible, it will not be a speedy or easy process to displace it. If British agriculture is going to succeed ultimately in holding the British market against the foreigner in this respect, it must supply what the bacon curer and the consumer want. If this is done there is no reason why the whole of British requirements in pig products should not be produced within the British Isles.

Certain reasons have been put forward from time to time to explain why farmers have not developed the pig side of farming. Possibly the most important of these reasons has been the periodical fluctuations in the price of pigs. It is, however, those breeders and feeders who have pursued a steady policy, and who have not jumped in and out of pig-keeping as the prices went up and down that have suffered least from the changes in market values. It is possible that fluctuations may occur again, but the increased operations of the home bacon factories should help considerably to stabilise prices. In any case a consistent policy of pig-keeping should be the safest course.

The prevalence of Swine Fever and Swine Erysipelas, together with the pressure of Swine Fever regulations, have also restricted development.

Inquiries which have been made recently with regard to the present position of the pig trade, have tended to show that the bacon factories already established in the country are able to deal with the present supply of pigs, and that some of them experience difficulty in obtaining the required quantities. Complaints are made that the pigs supplied, even when adequate in numbers, may be unsuitable in conformation, weight and feeding. Further, there is an increasing demand for pork which tends to reduce the supply of pigs for bacon.

In addition to the broader economic argument for pig-keeping on an increased scale, one must bear in mind certain other considerations in favour of the pig. The sow's prolificacy in rearing 16 pigs in a year compares favourably with the ewe or cow. The pig is invaluable in utilising glut products, for example, potatoes and barley as in the winter of 1922-23, and whey on cheese-making farms; and further, the pig is the most economical manufacturer of meat, putting on 1 lb. of live weight increase with less food than any other farm animal.

The Farmer's Aim.—In starting or reconstructing his pig-keeping the farmer should consider his market, and whether he is to cater for the fresh pork or bacon trade, or both. It is usual for good pork pigs to make a higher price per pound than bacon pigs, and to sell pigs for pork has proved, lately, a more profitable line of business than to supply pigs for bacon. On the other hand the pork demand is more subject to seasonal and other fluctuations. Bacon prices are steadier. Pork production is more speculative, but offers greater chances of profit.

The demand of the present day is for small joints of good quality pork and for mild cured bacon produced by young pigs.

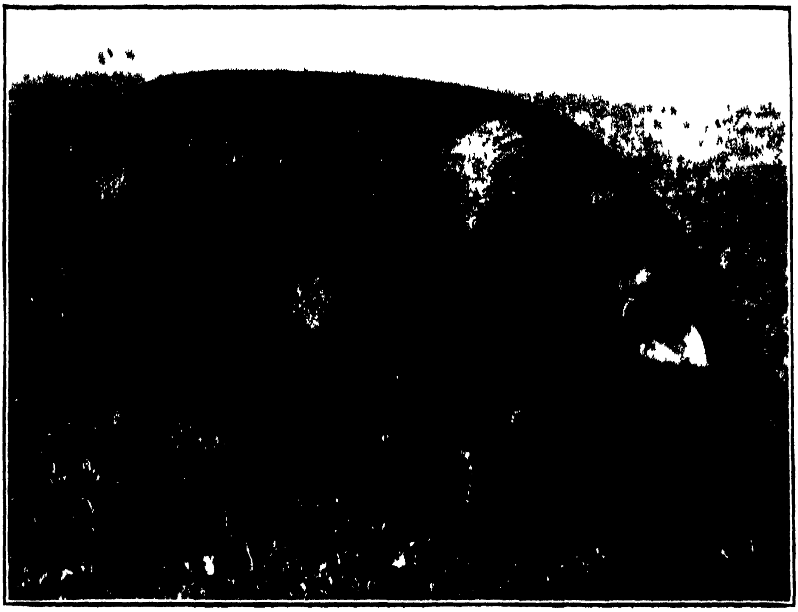

FIG 1.—Large Black Gilt Molly of Moulton 2nd—a dual purpose type of female pig which could be mated to breed bacon or pork pigs.

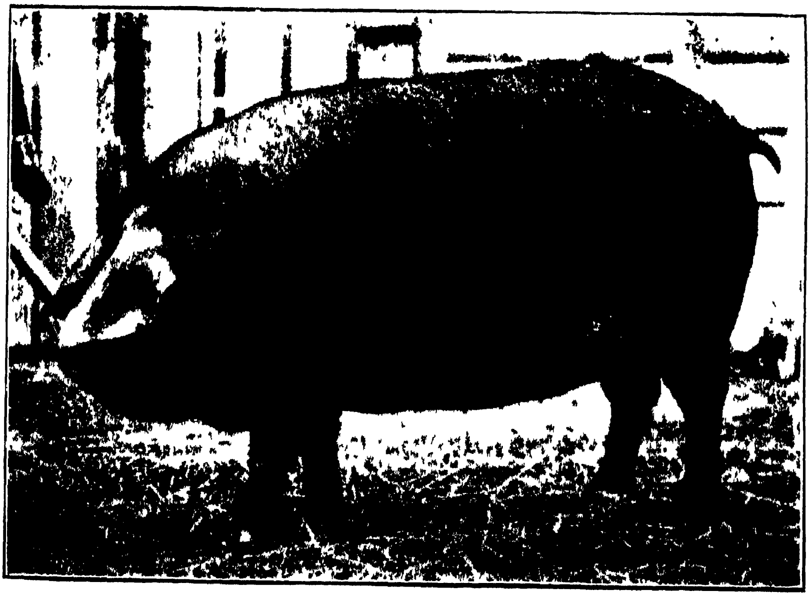

FIG. 2.—Large Black Sow—Cornwood Lass 67th—a typical bacon dam.

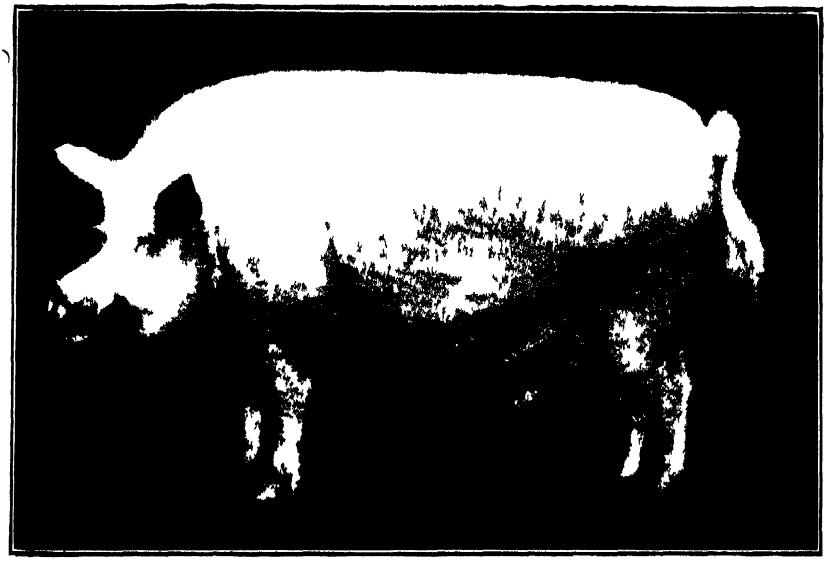

FIG 3 —Large White Boar—Worsley Jay 35th—a typical bacon sire

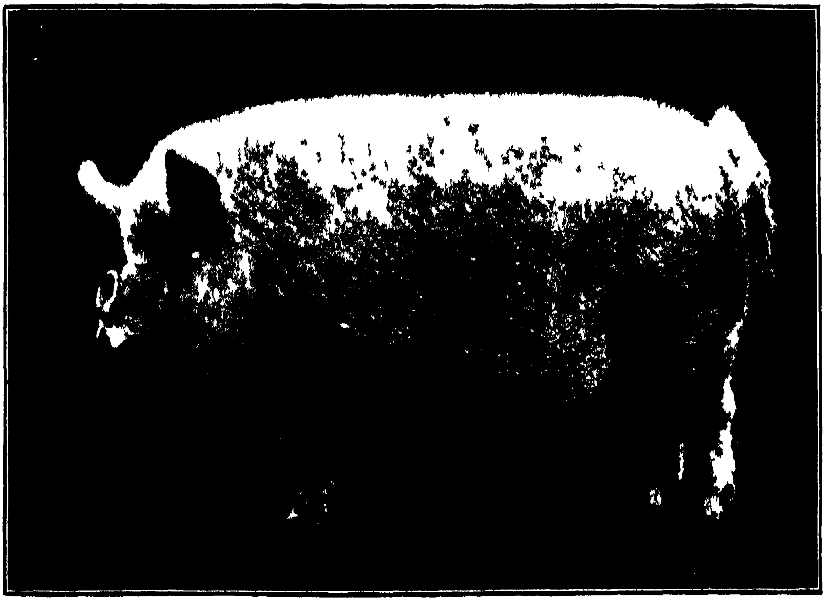

FIG 4 —Middle White Boar—Shrewsbury—a typical dual-purpose sire, suitable for breeding pigs either for pork or bacon

It is for this class of pork and bacon that the consumer will pay highest prices.

The size and degree of fatness, of joints of pork wanted, vary in different districts. The type of porker most popular on Smithfield market is one of about 90 to 100 lb. live weight and about 60 lb. dead weight at 4-5 months old, but the pork pig which is in most general demand throughout the country is one weighing 120-140 lb. live weight or about 100 lb. dead weight at about 5-6 months old. In certain manufacturing centres in the North Midlands and Black Country the "fat pork" pig is wanted: that is, a pig weighing 240-300 lb. live weight and about 180-220 lb. dead weight. The demand for "fat pork" is, however, strictly limited, and very frequently there is an over supply of fat heavy pigs. When such a surplus occurs these pigs make poor prices, actually about the same as fat sows, and they are then commonly used for sausage-making. Generally speaking the smaller the pig the higher the price paid per pound, and the heavier the pig the lower the price per pound.

Bacon curers appear to be agreed that the ideal type of pig for bacon should weigh from 200-220 lb. live weight and from 140-170 lb. dead weight, and should be fit to kill at 6-7 months old.

Thus we see that with the exception of the "fat pork" type, pigs should be ready for killing at 4 to 7 months old. Possibly the largest and keenest demand is for the pork pig of 5 score dead weight. The 3 score pork pig is required almost exclusively for the London market. The fat pork trade is the least attractive, since it is limited in demand, confined to particular areas and frequently over-supplied, more particularly because the older-fashioned feeders have not yet realised that the requirements of consumers have changed and that young, early-maturing, good quality pigs are what is now generally wanted.

It should be recognised that the cost of production of pork is higher in older than in young pigs. Professor Henry has given certain figures taken from a large number of experiments conducted in the United States, which show that to produce 100 lb. of live weight increase, pigs weighing 50-100 lb. live weight required 400 lb. of food; pigs weighing 150-200 lb. required 482 lb. of food, and those weighing 250-300 lb. needed 511 lb. These requirements are all slightly in excess of those obtained in this country recently with skilfully balanced rations, but they serve to illustrate the point that the heavier the fattening pig, the more food is required to produce 1 lb. of increase.

It is hardly possible to supply first-class porkets (8 score) and bacon pigs from the same litters, but it is possible to supply medium pork pigs of 5 to 6 score and bacon pigs of 7 to 8½ score dead weight from litters of the same pure breed or first cross. The porkets are wanted rather fatter than the baconers, but this can be secured by judicious feeding and management.

Scale of Business.—On most farms where pig-keeping is taken up on commercial lines, it will be found convenient and economical to have enough pigs to keep a man fully occupied in looking after them. It is also desirable that the farmer should breed the pigs required for feeding. He is in this way independent of buying in the ordinary market, and avoids the risk of introducing infectious or contagious disease, particularly swine fever.

The number of pigs which a man can look after will vary considerably, depending upon the system of pig-keeping, whether the pigs are confined to sties, or kept under some modification of the open-air system, whether the whole unit is conveniently arranged or the pigs are scattered about the farm, the convenience of the water supply, and so on; but it may be taken as an average figure that a man can attend to about 120 pigs.* Taking 120 as the unit and assuming that the farmer is breeding and disposing of his pigs partly as pork at about 5 months old and partly as bacon at 6-7 months, with the sows farrowing twice a year, a herd of about 120 pigs would be maintained with 12 to 15 breeding sows and 1 boar. This assumes that the average selling age will be about 6 months, that the litter of a sow will be ready for sale by the time she is due to farrow a second time, and also that each sow rears 14 to 16 pigs in one year.

Capital Required.—The total capital required to start pig-keeping on these lines will depend upon how much has to be spent on open-air shelters and fencing. It is usually possible to make use of existing buildings with or without some minor adaptations. Strongly-made wooden shelters big enough for a sow and litter, or for 12 small stores or 8 to 10 bigger stores will cost about £10. Much cheaper shelters of a temporary character can be improvised. Wire pig fencing and posts at present prices will cost about 9d. per yard. It is not wise to attempt to economise by buying second-rate breeding animals. Whether it is intended to keep the herd pure or to go in for crossing, good pedigree animals should be selected as foundation stock. Useful in-pig gilts or young sows of this type will cost from £12 to £20 each, and a suitable boar, fit for service, could be bought at £15 to £25. Over and above the outlay for stock and appliances a reserve of capital of £250 would be needed for the purchase of feeding stuffs and payment of labour and overhead charges until the first returns from sales of pigs are received.

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* Dr. A. G. Ruston, this *Journal*, July, 1920, p. 342.

General Management.—In order to make the most of the concern the farmer will need to develop keen business instincts. He must learn when it is more economical to use home-grown grain than to sell it and buy other feeding stuffs. Such feeding stuffs as he does buy must be bought with judgment, and he must learn to make up his own rations and not rely on expensive proprietary meals.

With regard to markets it should be his endeavour to sell to the best advantage. It may not be advisable to depend entirely on the local auctions. He should watch the prices at Smithfield and other important centres and compare what he is getting locally with the prices current elsewhere. If there is no weighbridge on the farm he can, by means of a spring balance and crate, weigh representative pigs before they go to market and estimate the price he receives per score. It may be a good policy to send wagon loads direct to London—this would apply particularly in the case of small pork pigs. In the matter of bacon pigs it would doubtless be advantageous both to the farmer and to the bacon-curer to have a definite contract for the supply to the bacon factory of so many pigs at certain stated intervals. Where this is done the farmer should insist upon getting a substantial premium on all pigs which conform to the standard for first-grade bacon pigs.

It is an old saying that pork pigs are not wanted and should not be marketed in the months without an "R"—May, June, July and August. Although there is a good deal of sound sense behind this saying, it is nevertheless true that the demand for pork in the summer months has greatly increased within recent years. Many people endeavour to clear out their pork pigs before May, and then to sell in September those which have accumulated in the summer, with the result that the markets are often overloaded in March and April and again in September.

Breeding of Pedigree Pigs.—So far we have considered pig-keeping from the standpoint of breeding and selling for killing. There is, however, the very important aspect of the position from the point of view of pedigree pig-breeding. Pedigree breeding has done much to promote the production of better pigs. There are possibly certain advantages for commercial purposes in the first cross between two pedigree breeds, but it must not be overlooked that much successful commercial pig-keeping is carried on with pedigree animals. It is often possible with pedigree stock to sell some animals of individual merit at highly remunerative prices, and these prices more than compensate for the extra trouble and time spent in recording pedigrees, in marking, and so on.

To be a successful pedigree pig-breeder, however, a man must be an enthusiast. If he is an enthusiast he should soon become a tolerably good judge, and by paying attention to careful selection and mating he should in course of time build up a good herd. Where the beginner often fails is in registering and keeping for breeding too many of his pigs.

The motto of the pedigree breeder should be to "cull hard," and to send to the butcher or bacon factory all animals except those which have real merit to recommend them. The smaller breeder who starts enthusiastically often gets disappointed through failing to find a good market for his best pigs, and there can be no doubt that collective shows and sales, when properly conducted, form a most valuable outlet for good pigs, particularly for those who are not well enough known, or are not in a sufficiently large way of business to hold successful home sales. These collective shows and sales deserve more encouragement and support.

Duties of the Pigman.—In pig-keeping a good pigman is an extraordinarily important asset. The main thing is to get a man who is intelligent, keenly observant, and thoroughly interested in his work. It is very important that he should observe closely in order to see when pigs are ill or off their food, when sows are in season, and the many other small details which collectively make much difference to the balance sheet. He should know the individualities of his sows, and if he treats them properly he will be able to handle them quietly. It is a good indication of how a man treats his pigs if he can go up to, and handle them in the field, or if they follow him readily when they are called. An intelligent, observant pigman deserves good wages. A bonus of so much per head on each pig weaned, or on each pig which reaches a certain weight in a given time on a weighed ration will do much to encourage him and stimulate his enthusiasm.

Breeds and Suitability for a Particular Purpose.—In selecting a breed or cross the farmer must consider what he is going to sell. If his intention is to sell small pork pigs he should choose breeding pigs likely to produce animals which will suit the requirements of the butcher who purveys small pork. If his object is the production of high-class bacon he will find guidance if he ascertains the type of pig wanted by the bacon curer. It is possible that the farmer may find several breeds which appear likely to produce the particular kind of pig which he wants.

The Pork Pig.—It has been pointed out that in the case of pork there are three different sizes and weights in demand, but irrespective of weight a good carcass of pork should show a suitable proportion of lean to fat meat. There should be a small proportion of bone and offal. Great length of body is not so essential as in the bacon pig. The head should be broad between the ears, but the jowl, neck and shoulders should not be heavy. The back and loin should be broad and heavily fleshed, the ribs well sprung, the streak and belly thick and well developed, the hind-quarter square, the tail set high, the hams heavy and fleshed down to the hock. The bone should be fine, and the skin thin and not wrinkled, the hair silky and not too abundant. A heavy jowl, strong neck with crest and mane, and heavy shoulders are usually associated with a coarse type of pig. Good quality is essential, and as indications of quality attention should be paid to the bone, skin and hair. A good pork pig will have a high percentage of the most expensive cuts; these are obtained chiefly from the back and loin. For the small and medium pork requirements early maturity is a most important consideration. The pork pig, like the bacon pig, should be free from "seedy-cut." White colour and smooth skin are desirable, as a pig with these characteristics is more easily dressed. A tradesman in a small way of business is much influenced by these points, as he is usually without those special facilities for dressing pigs which are found in the factories and large wholesale businesses.

The Bacon Pig.—The ideal type of pig from the bacon curer's standpoint is a long-sided pig with muscular wide back, wide thick firm loins, heavy hams fleshed to the hock, light head, neck and shoulders, thick streak and belly, to weigh dead 140-170 lb. at 6-7 months old. The carcass should show a high percentage of lean to fat, and should be thin skinned. The "Prime Streaky" lying behind the elbow and forearm should be thick and the back fat should not measure more than 1½ inches in depth at any point.* The middles from such a carcass will weigh 3 or 4 lb. more than the ends. This description holds good for the Wiltshire side. In the northern counties for the ham and cutting-up trade a somewhat heavier pig is wanted. The type is, however, the same, and it simply means that for the northern demand the same sort of pig will suit if fed six weeks longer.

When breeding for bacon, pigs that are poor in the hams, short in the back, with coarse wrinkled barrel-shaped sides and narrow behind the shoulders should be avoided. Heavy limbs, heavy fore-quarters, thick skins, coarse hair and bristly manes are equally undesirable.

The ideal bacon pig when fattened should be long, straight on top and underline, not "paunchy," square at the tail-head, light at the shoulder, and fine in the bone.

The ideals laid down for pork and bacon can be secured without difficulty from existing breeds.

Pure *v.* Crossbred Pigs.—Butchers and bacon curers want uniformity. Uniformity cannot be obtained by breeding from mongrels. The only ways in which to secure uniformity of type are to breed pure-bred animals, or definite first crosses between two distinct breeds, and as there is variation in type within some of the breeds, the breeding sows in any one herd should be as uniform as possible. It is invidious to single out particular breeds or crosses, and the following points are given simply for the guidance of prospective breeders of commercial pigs.

For Pork—For "small pork" production the two breeds which are regarded as specially suitable are the Middle White and Berkshire. High-class small pork can be bred from either one of these breeds or by crossing the one with the other. Of the two the Middle White would appear to possess rather earlier maturing qualities, to be rather more prolific, and have an advantage from the butcher's standpoint in the white colour. A white boar used on a coloured sow, however, will usually beget white progeny.

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* The "middle" is that part of the pig which reaches from behind the shoulder to the ham.

For "medium pork" as represented by the pig of 5 score (100 lb.) dead weight, either of the two pure breeds mentioned, or a cross of either of them with one or other of the bigger breeds, would be suitable. The Middle White-Large White cross is popular in some districts, but requires good housing and conditions, and the Middle White-Large Black cross is becoming increasingly esteemed. Both these crosses have the advantage that they can be used also for bacon at 140-160 lb. dead weight. The Berkshire-Tamworth cross is favoured in certain Midland counties and has the reputation of producing a good quality carcass. This cross-bred is, however, rather slow in growing and not specially thrifty.

For "fat pork" the bigger heavier breeds might be more suitable than the Middle White or Berkshire. The Lincolnshire Curly Coated Pig has long been used for producing a fat heavy carcass. The Cumberland yields a useful carcass of this type with good hams.

For Bacon.—With regard to bacon production, Denmark produced her high-class bacon pigs by the judicious use of British White boars on the native "Land Race" breed. It has been suggested that in this country the ideal bacon pig can be most easily secured by crossing the Middle White and Large White and then mating this first cross sow with a Large White boar. The question for the farmer to decide is whether the breeding of bacon pigs in this way is the best proposition open to him, or whether by using a breed or cross which may be better adapted to his particular farm and conditions he can, by careful selection of foundation stock, still produce a useful type of bacon pig at possibly less cost. The crosses obtained by the use of a Large White boar on sows of most of the heavier breeds seem to give general satisfaction to bacon curers. Of the newer registered breeds the Welsh in particular appears capable of producing high-class bacon pigs.

As a breeder, as a milker, as a forager, and to live cheaply out of doors, the Large Black sow has many good points, and she is generally recognised as being specially suitable for open-air pig-keeping. Unfortunately, the Large Black, like other coloured breeds, suffers occasionally from the blemish known as "seedy cut." "Seedy-cut" is a black spotty discoloration of the milk ducts in the belly, and occurs in some female pigs, depreciating the value of the side. The progeny of a Black sow and a White boar are generally white and therefore free from "seedy-cut," unless there is visible black colouring along the belly, which is very rare.

The cross produced by the Middle White boar and the Large Black sow would appear to merit more attention from commercial breeders. Both parents are thrifty and cheap to keep. The Large Black sow is more suitable for rough conditions than the Large White. The Middle White-Large Black cross has the great advantage of being a reasonably good dual-purpose animal suiting both the pork butcher and the bacon curer. It possesses early maturity in a high degree, and by those who breed it, is esteemed for its vigour and constitution and the readiness with which it responds to feeding at an early age.

Although it is true that there are many more good pigs in the country now than there were in 1914, the common pig is still more or less a mongrel with little merit to recommend it, and there is great scope for general improvement. Mongrel bred boars are still used for breeding, and this is altogether wrong. Education as well as inexpensive supplies of good boars could do much to secure a sounder breeding policy. The importance of early maturity and the attainment of weight for age cannot be too strongly emphasised, but it appears that possibly too much stress has been laid by breeders upon the ultimate attainment of great size. The big majority of pigs are now wanted for killing at comparatively light weights. What is generally required therefore is a pig which will produce a ripe carcass suitable for its particular purpose at an early age. Such a carcass should be of good quality.

In the cattle breeding world, the breeders of Aberdeen-Angus cattle stand out prominently as having succeeded in developing an early-maturing breed of beef cattle of first-class quality. In the selection of their breeding stock, these breeders chose animals which along with other breed characteristics possessed fineness of bone, and we venture to suggest that in pig-breeding. if early maturity and quality are two essentially important aims, then sires and dams with fine bone must be selected. Certain pig-breeders believe that a sire should have strong bone and an appearance technically described as "sour." This may be necessary if great size is the ultimate object, but it is unusual to find these "sour" sires breeding pigs of the quality and type for which the pork butchers and bacon curers are asking. The day of the big, heavy, fat pig is over and done with; and the sooner this is generally realised the sooner the consumer will be supplied with the article for which he is prepared to pay top price.

LAND DRAINAGE WORKS FOR THE RELIEF OF UNEMPLOYMENT, 1922-23.

OWING to the continued conditions of winter unemployment among rural workers, aggravated by the depressed condition of agriculture generally, funds were again allocated to the Ministry for land drainage works during the winter of 1922-23.

In the issue of this *Journal* for September, 1922 (pp. 488-494), an account was given of the similar operations conducted during 1921-22—the first period for which money was voted for this form of relief work.

The present article deals with the second grant for this purpose, covering the period from October, 1922, to May, 1923. The Ministry addressed circulars to all Drainage Authorities and County Councils on 6th September, 1922, inviting them to submit schemes and estimates for the improvement of drainage and sea-defence works within their respective areas. County Councils were also invited to submit schemes for water supply to farms or groups of farms.

The terms and conditions set out in each of the circulars were similar to those which obtained in the previous period, the works to be completed before 31st March, 1923. The admitted success of the 1921-22 schemes, both as a relief measure and as a means of effecting solid improvements to several hundred thousand acres of waterlogged land, led to a large increase in the number of schemes submitted. It soon therefore became necessary to ration the allocations of funds in order to spread the schemes over as wide an area as possible to ensure that all rural areas received equal treatment. Eventually, however, sufficient savings were foreseen on schemes already approved to enable grants to be made in aid of all schemes which could be approved on their merits.

Unfortunately the weather conditions were not so favourable as during the previous winter, the rains and floods which occurred early in 1923 causing many schemes to be delayed, curtailed or even abandoned.

Of the 667 schemes for drainage, sea defence and water supply submitted, 531 were approved and carried out, providing employment for 1,018,976 man-days.

The local rate of wages for unskilled agricultural workers as fixed by Conciliation Committees was the normal rate in each case. Skilled men were restricted in the proportion of one to ten unskilled, and in drainage and sea defence schemes the expenditure on materials was generally limited to about 20 per cent. of the wage estimate.

A beginning was made during October, 1922, and work proceeded smoothly until January, 1923, when flood conditions began to hamper progress, and eventually sanction was obtained for an extension of time from 31st March to 31st May. A further extension of time to 16th June was obtained in a number of special cases to secure the completion of works delayed through various causes.

Divisional Areas.—The country was divided into 7 areas for the purposes of inspection and supervision as under:—

Area No. 1.—The Ouse Catchment Basin, with the whole of Norfolk and Suffolk.
„ *No.* 2.—The counties of Cheshire, Stafford and Warwick and all counties to the westward, including the whole of Wales.
„ *No.* 3.—All counties northward of a line drawn from the Mersey to the Humber.
„ *No.* 4.—The counties of Lincoln, Leicester, Nottingham and Derby.
„ *No.* 5.—The counties of Essex, Kent, Sussex, Surrey and Middlesex.
„ *No.* 6.—The counties of Wilts, Gloucester and Somerset.
„ *No.* 7.—The counties of Oxford, Berks, Bucks, Herts, Hants, Dorset, Devon and Cornwall.

Numbers employed.—The numbers of men employed were as shown in the following table:—

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.
574	2,299	4,537	6,250	7,754	8,625	9,182	8,892	4,471

The total man-months worked amounted to 52,584. The largest number of men employed during any single week was 9,879 for the week ending 28th April.

Of the above numbers it has been ascertained from inspectors' reports that 71 per cent. were ex-Service men, and that 77 per cent. were agricultural or other rural workers.

With regard to the percentage of ex-Service men it should be explained that many rural workers were absorbed on war work in a civilian capacity. In schemes near towns the percentage of ex-Service men reached 87, and in rural schemes was on an average 60 per cent.

The men have worked cheerfully and well, particularly on schemes where the work was well organised and well set out. The average man realised that here he was doing something really useful and not merely digging a hole for his mate to fill in.

Cases in which numbers of men have tramped or cycled many miles daily to and from work could be quoted all over the

Area No.	Numbers of Schemes.			Submitted by		Totals.	Number of man-days worked.	Approximate Expenditure.			Approximate acreage benefited or protected from inundation.
	Drainage.	Sea Defence.	Water Supply.	Drainage Boards.	County Councils.			Drainage. £	Sea Defence. £	Grants in aid of Water Supply. £	
1	58	6	3	42 4 —	16 2 —	67	230,700	66.924	2,648	280	225,192
2	82	1	5	21 1 —	61 — 5	88	97,057	32,583	2,310	544	63,791
3	26	4	1	7 3 –	19 1 1	31	73,688	21,229	6.105	27	46,760
4	51	7	2	37 7 —	14 — 2	60	197,569	35,642	34,751	11	315,544
5	27	26	—	20 12 —	7 14 --	53	230.018	34,157	46.273	—	122,363
6	103	3	73	22 3 —	81 – 73	179	146,560	28.792	1,619	7.307	121,937
7	38	—	15	3 — –	35 – 15	53	43,384	9,028	—	2,189	17,151
Totals	385	47	99	182	349	531	1,018,976	228,355	93,706	10,358	912,738
	531							£332,419			

Note:—Expenditure shown for Drainage and Sea Defence is approximate only, and is somewhat higher than final figures.

country. The nature of the work was heavy, and in many cases was of a distinctly unpleasant nature, where many years' accumulation of mud and filth had to be removed from water courses, and where in the course of operations for sea defence in remote localities, blinding squalls of hail or rain and knee-deep wading in the marsh mud, were the daily lot over a long period.

In several cases, Boards of Guardians have co-operated with Drainage Authorities and County Councils in organising schemes with conspicuous success, enabling the local relief of unemployment at a low cost to the rates, and securing the carrying out of much larger schemes of work than the Drainage Authorities could normally afford.

Analysis of Cases.—The table on p. 521 gives an analysis of the cases dealt with in the various districts, and shows in some measure the proportionate distribution of the funds in relation to the extent of rural unemployment. The total acreage of land benefited is worthy of note.

Voluntary Schemes organised by County Agricultural Committees numbered 349, of which 250 were schemes of Land Drainage and Sea Defence executed at a total cost of £76,182, and 99 were Water Supply Schemes above mentioned for which grants were made totalling £10,358.

The most active county was Wiltshire, where no fewer than 51 Land Drainage Schemes and 45 Water Supply Schemes were carried out, providing employment for 68,590 man-days and benefiting an area of 54,800 acres.

Gloucester was another county responsible for a large number of schemes, which included 24 schemes of Land Drainage and 24 of Water Supply, providing employment for 22,826 man-days and benefiting 19,028 acres.

Other counties in which a fair number of schemes were organised are:—Warwick, Anglesey, Pembroke, Kent, Oxford, Hants, Essex, Dorset, Durham, W. Riding of Yorks, Northampton and Suffolk.

Where so many excellent schemes are included, it is difficult to particularise, but the photographs accompanying this article, which may be classed as typical of the schemes in general, illustrate to some extent the conditions met with, and the nature of the improvement works. In Cornwall, where opportunities for drainage improvements are the exception, much useful work on a small scale has been accomplished.

Many cases could be quoted where large areas of waterlogged land, some of which had deteriorated into impassable bog, have

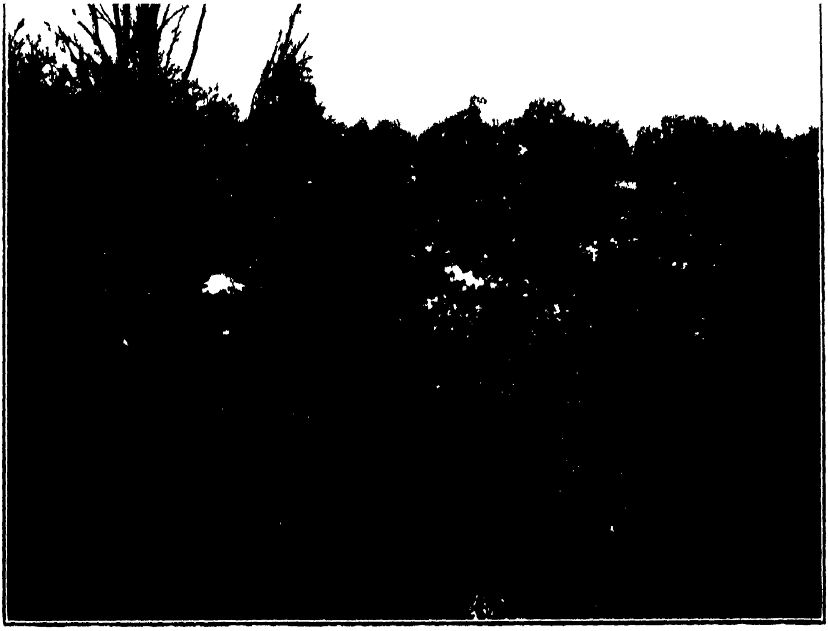

FIG. 1.—The river Lark near Hengrave Bridge, before cleansing.

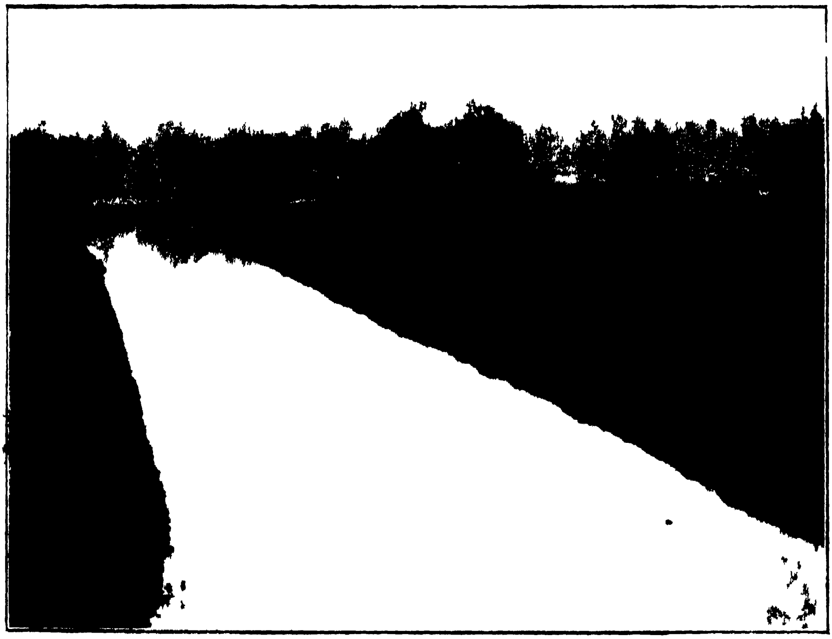

FIG. 2.—The river Lark after being cleansed.

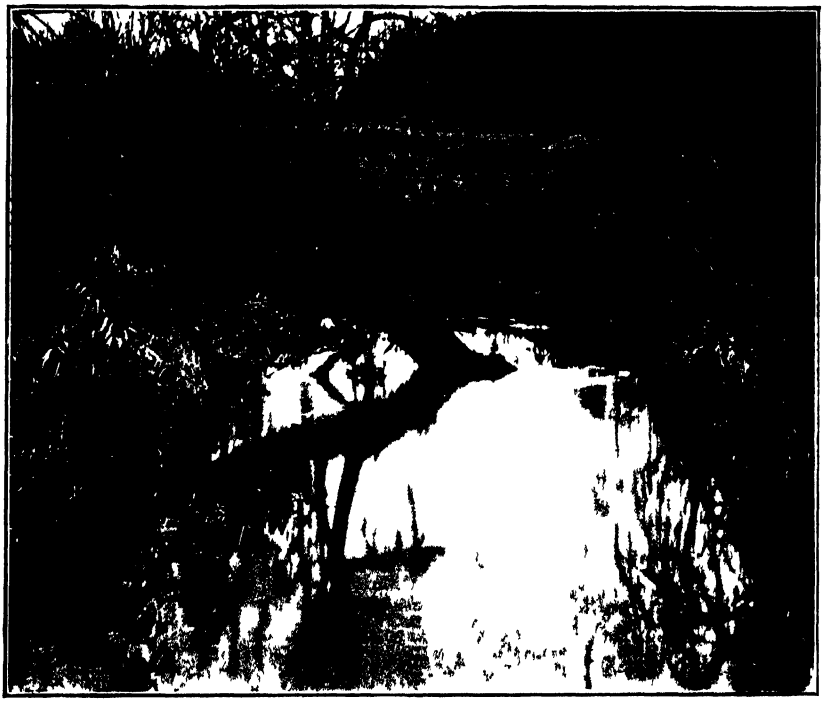

FIG 3 Stream at Easthampstead, Berks before cleansing.

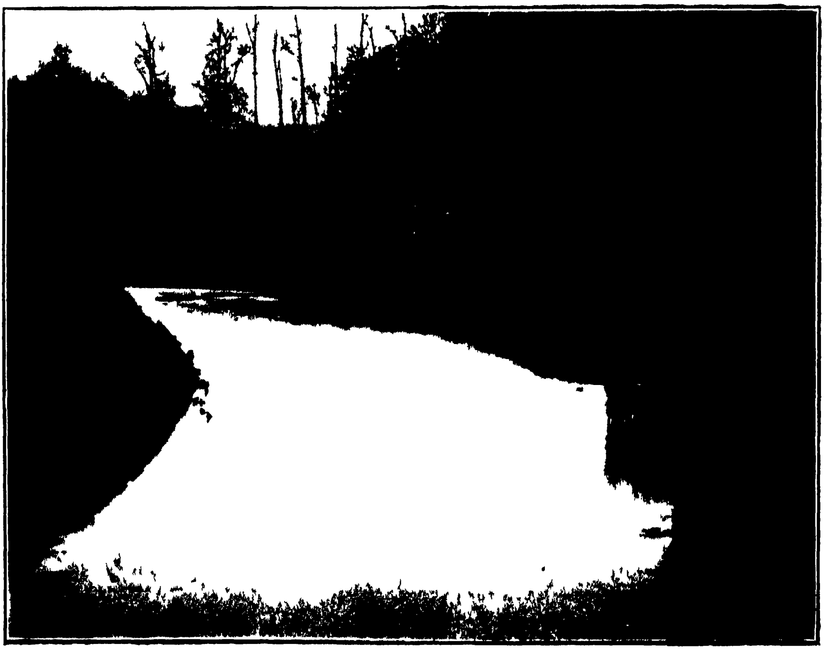

FIG. 4 – The stream after being cleansed.

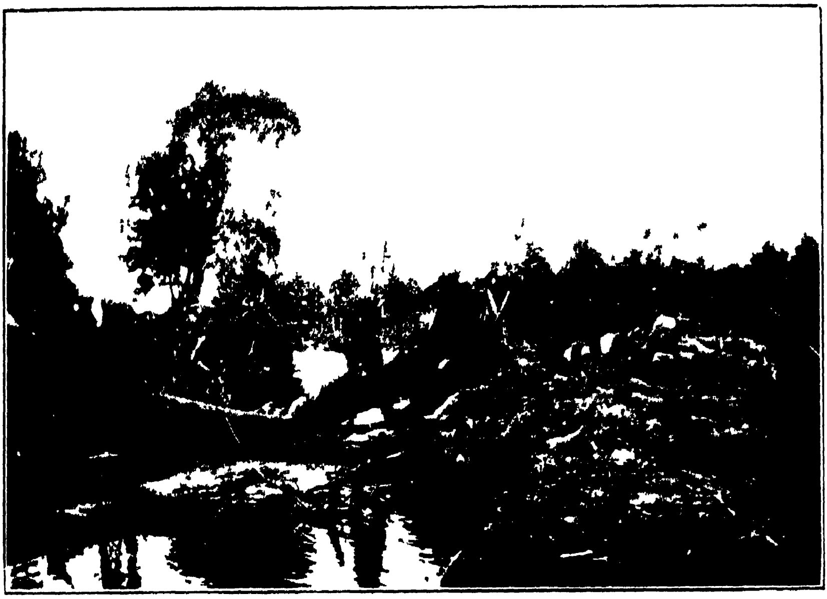

Fig. 5.—The river Elbe, Wilts, before cleansing.

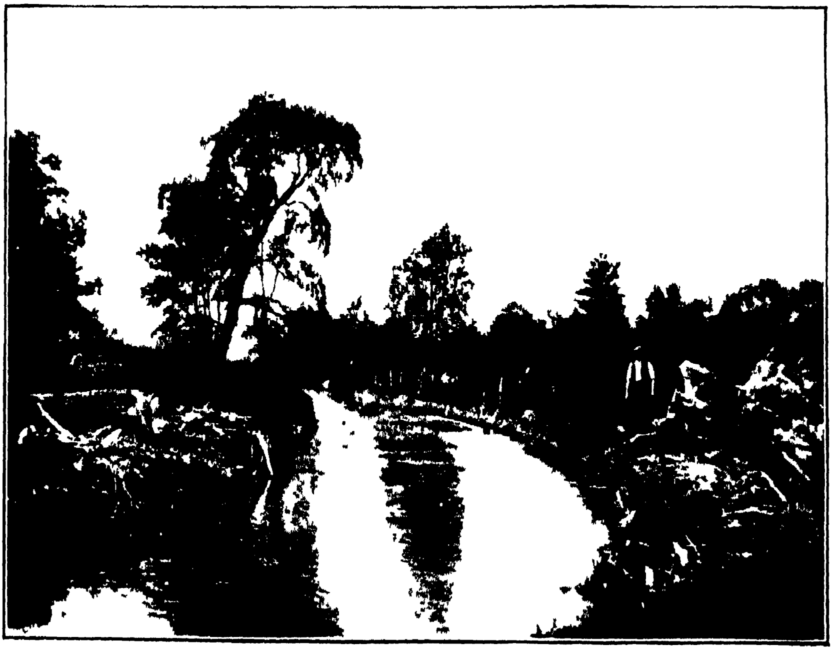

Fig. 6.—The river Elbe after being cleansed.

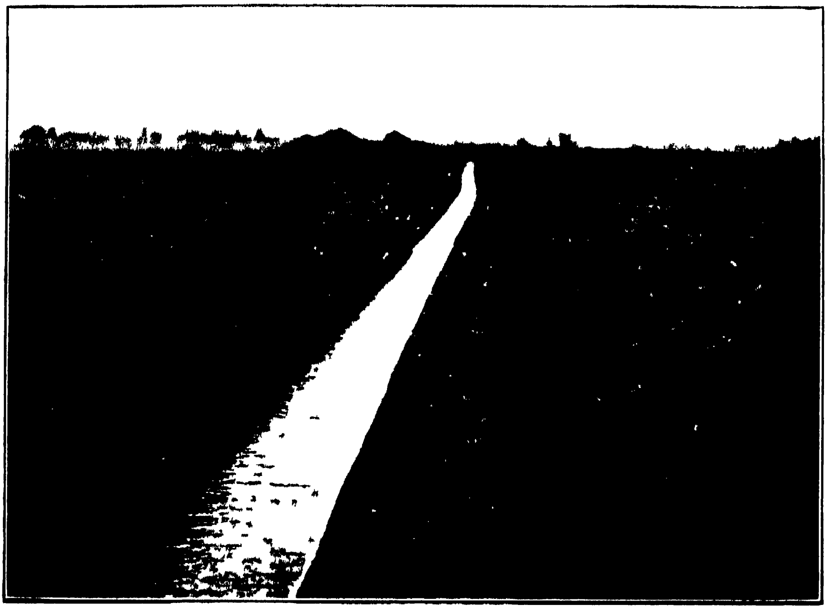

FIG 7—Main Drain near Crowland, Lincs

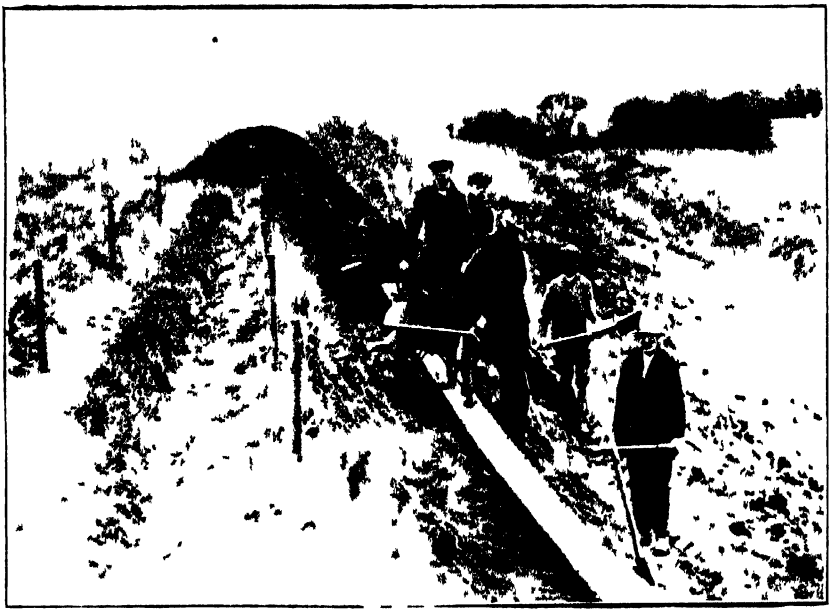

FIG 8—Dengie Levels, Essex Raising and Breasting a Sea Wall

been reclaimed by the voluntary co-operation of owners in these schemes, through the agency of County Agricultural Committees.

As in the previous period there was a tendency on the part of owners of land at first to assume that under the conditions of working with unskilled labour, and in spite of the Ministry's grant, the work would prove expensive. However, as the schemes proceeded and it was found that such was not the case, there was a general desire for more schemes and for extensions of schemes in progress. In some cases it has been definitely ascertained that work under these schemes has been executed as effectively, and as cheaply, as it would be done at pre-war piece work rates. This reflects great credit on the officials in immediate supervision of the schemes, and also shows the desire on the part of these unskilled workers to make good.

In Kent and Sussex the schemes were mostly those for sea defence, and upwards of 12 miles of sea wall have been raised and strengthened during the winter of 1922-23, in continuance of 1921-22 work, the need for which was emphasised by the high tide of November, 1921.

It may be mentioned that the reason for the apparent reluctance on the part of some County Authorities to prepare schemes has been the lack of the necessary staff. The preparation of each scheme for submission is a lengthy task. Not only had the watercourse to be surveyed and the work estimated, but undertakings had to be obtained from the persons affected for the recovery of one-third of the cost. Where the services of a Drainage Officer had been retained, the schemes have been more in number, and wider in scope than elsewhere.

Drainage and Sea Defence Authorities were responsible for 182 schemes at a total cost of £245,879, of which amount £161,892 was spent on schemes of Land Drainage and £83,987 on sea defence.

Of the *Drainage Schemes*, the most striking achievements are those of some of the recently-constituted Drainage Boards:—

By the Ouse Drainage Board, the straightening, widening and deepening of the rivers Ouse, Lark, Ivel, Cam, Thet, Granta, etc., over a total length of 55½ miles, providing employment for 54,214 man-days; by the Chelmer and Blackwater Drainage Board, the general improvement and pioneer work on the whole of its main channels, in continuance of work commenced in 1921-22, over a length this season alone of 107 miles, providing employment for 34,118 man-days; by the River

Stour (Essex and Suffolk) Drainage Board, the clearance of the tributary streams over a total length of 35 miles, and affording employment for 23,728 man-days; by the Welland Drainage Board, works of improvements affording employment for 2,567 man-days, which works have met with much approval; by the Quadring Fen Drainage Board, and by the Loddon and Blackwater Drainage Association in improvement works of a substantial nature, conferring great benefit to a large area of exceedingly waterlogged land.

As might be expected, the majority of the larger schemes were promoted in the Eastern Counties where drainage works are a vital necessity. A large proportion of the works in the Fens was for the protection of low-lying land from river or lode flooding by the raising and strengthening of old flood embankments over a length of 60⅞ miles.

Sea Defence Schemes were undertaken on a large scale by the Alford and Spilsby Court of Sewers in the reconstruction of a further length of the sea defence between Skegness and Mablethorpe. When this length is finally completed, it is expected that the low-lying lands adjoining the coast and embracing 40,000 acres in this area will be rendered safe. This work afforded employment for 68,577 man-days, and could never have been done by the authorities out of their own resources. Moreover, it absorbed the whole of the unemployed over a wide rural area.

The Maldon, Wivenhoe and Clacton Drainage Board undertook its initial works in the improvement of its sea walls over a length of 90 miles. Over 25 miles of sea walls were raised and reconditioned, including repair of stone pitching, provision of groynes, and repairs to 35 sea sluices. Under the agency of this Board, the sea defences of West Clacton were reconstructed, and the area between St. Osyth and Clacton rendered safe from sea encroachment. A total of 48,895 man-days were worked on this Board's schemes.

The Arundel Sewers Commission continued the work of raising and strengthening its tidal embankments along the river Arun over a length of 7¼ miles, including repairs to sluices and the construction of groynes; providing employment for 30,548 man-days.

The Pevensey, etc., Levels Commission of Sewers continued effective groyne work on the Pett Level Frontage and have now removed all immediate danger of tidal inundation after being on the brink of disaster for several years. This work provided employment for 6,589 man-days.

Other effective sea defence work was undertaken by the Commissioners of Sewers for Dengie Levels on the repairs to sea walls over a length of three miles, and providing 9,078 man-days' employment.

Results.—(*a*) 385 schemes for the improvement of drainage channels, lodes and subsidiary drains resulted in 2,105⅜ miles of watercourses being cleared of growing and dead timber, and other obstructions; and in the improvement of sections and gradients by the removal of cesses, shoals, bends, and weed accumulations of many years. This work has effected improvement to 746,681 acres of land.

(*b*) 47 schemes for sea defence embraced the raising and strengthening of earthen walls, repair of stone and concrete pitching, provision of timber and fagot groynes, repairs to sluices, etc., etc., over a total length of 88⅛ miles, and affording protection from tidal inundation to 166,057 acres.

(*c*) 99 schemes of water supply were carried out chiefly in the higher portions of those counties still suffering from the drought of recent years. They included the building of concrete reservoirs and the tapping and piping of springs.

In a few cases hydraulic ram installations were carried out, and in practically all these water-supply schemes the estimated cost of materials was higher than that of labour: the Ministry's grant covered the cost of unskilled labour only.

It has been ascertained that the actual expenditure in these cases is about four times the amount of the grant, therefore affording considerable additional employment of direct and indirect labour.

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THE MANUFACTURE OF WALKING STICKS AS A RURAL INDUSTRY.

(*From the Rural Industries Intelligence Bureau.*)

THERE are two main types of walking sticks, the natural and the artificial, or, to be more correct, "manufactured." The former are sticks which are obtained practically to shape as cut from the plantation, and the latter are the turned and artificially bent sticks which have undergone several processes before they can be termed finished articles.

Natural Sticks.—Natural stick cutting is a healthy and largely open-air occupation, but is not as a rule a highly remunerative one unless a good connection is obtained. The stick cutter in a small way of business sometimes purchases the right to cut in a particular wood or plantation, but unless the industry is on a considerable scale, combined perhaps with artificial stick manufacture, it must be considered more suitable for a part-time or seasonal occupation than as the sole means of livelihood. It should be, however, particularly well suited to many partially disabled ex-Service men, especially where they need a country life or are unfitted for employment in urban industry.

There is a considerable demand for this kind of stick, and while the home products are by no means negligible, there is a large volume of imports, both of material and finished articles, and many sticks of both types are made of wood which is not native to this country.

There is a tendency on the part of English stick cutters to regard their processes as secret, and this may operate to restrict the home trade and narrow the numbers employed in it to a select few whose special methods of treatment are, in many cases, a family possession to be handed down from father to son. While there is no doubt that in a craft of this sort long experience provides the worker with many wrinkles, process details, and time and labour-saving devices, these can hardly be regarded as secrets. In this article, however, confined to a description of methods of working in broad outline only, they can only be incidentally alluded to.

Although we have referred definitely to walking sticks, the cutter would not confine his attention to those; there is quite a good demand for his product from umbrella and sunshade manufacturers, both for the stick and handle separately as well as combined, and there are many firms of manufacturers in London and the provinces who are always on the look out for new materials and shapes. So great is this demand that, on the Continent especially, many growers cultivate sticks of various good kinds, solely to supply this market. Little, however, is done in this way in England. Land is generally of too high a value for such cultivation, though one instance has come to our notice where in one of the home counties large quantities of ash saplings have been grown for sticks, with the roots all directed one way, to form cross heads.

The English natural stick-cutter has a large variety of materials to select from, some being more suited for umbrellas and sunshades than for sticks proper. Among them may be mentioned the following:—Ash, aspen, birch, blackthorn, cherry,* chestnut,† crab apple, elm, furze or gorse, hazel, holly, hornbeam, maple, mountain ash, whitethorn or hawthorn, etc. When the roots have sufficient size or characteristic shape to form handles or knots the saplings are used, but sometimes also the small branches of larger trees. When cutting for sticks the total length should not be less than 42 in., and preferably 48 in., and they should be between ½ in. and 1 in. diameter at about the middle of their length, and the diameter should diminish fairly evenly from the root to the tip. If branches are cut, a piece of the parent stem should be left to assist in forming the crook.

Dyeing, Straightening and Peeling.—Before it is ready for sale the natural stick undergoes a good deal of manipulation, and various other processes, such as peeling, trimming, bending, polishing, staining, etc., according to the requirement of the finished article. The knowledge and experience of the cutter is particularly needed in estimating, from the appearance of the growing plant, whether it is a good one for his purpose and can be made up with a minimum of difficulty.

Sticks should not be cut earlier than October nor later than the beginning of March. The best period for cutting or pulling is from December to the middle of February. After cutting they should be stacked in a cool and fairly dry place until half dry. The period allowed for this will depend a great deal upon the material and upon local conditions, and must be left to the experience of the worker; it may be anything from 3 weeks to 3 months. Artificial drying is often resorted to, but natural drying produces the better and more durable stick. When the sticks are half dry and the bark is shrunken and will not peel easily, they may be trimmed, straightened and bent as desired. Some sticks, such as oak, are best when barked entirely, others—elm, for instance—frequently have the bark left on entire except at the handle and ferrule end; in other cases they are peeled in patches, some bark being left on for ornamental purposes. As a rule the better-class stick is peeled entirely, trimmed and smoothed, and after seasoning, polished or varnished.

There are many methods of straightening, in fact, individual workers are seldom found to use exactly similar processes, and it is remarkable to those ignorant of the craft, what can be done by skill and experience in straightening and bending the most irregularly grown and crooked sticks. The following are among the more common methods of producing suppleness preparatory to bending:—

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* The English cherry is not so much used as what is known as the "tiger cherry," imported from Hungary.

† Spanish chestnut (*Castanea sativa*).

(1) The sticks may be exposed to steam vapour.

(2) A bath of damp sand is kept at a temperature about equal to that of boiling water by being placed over a very hot stove, and the sticks are plunged into this until hot and quite supple. This, or a variation of it, is the common method.

(3) Another method of drying and straightening single sticks quickly is to insert them after rough straightening into a metal tube, such as a piece of iron gas pipe, of a suitable size, boil it in the tube for about an hour, then dry it in its tube quickly, either by putting stick and tube in the chimney above the fire for 24 hours or so, or by other suitable artificial means. This method is sometimes practised on green and unseasoned sticks, but these are not as a rule durable.

There is no hard and fast rule as to peeling either before or after straightening; both methods are practised, and often by the same individual, according to the wood he is using and the class of stick he intends to make. The bark may be removed with a sharp knife, care being taken not to damage the wood underneath; or the sticks may be immersed in hot water rather below boiling point for an hour or so; or better still, they may be put into cold water, and slowly heated, water and sticks together, for about 3 hours, after which they can be easily peeled by hand.

The equipment of the small stick maker is often of the simplest and crudest description, and his straightening and bending apparatus is no exception. He usually has a stout bench running down one side of his workshop or outhouse, with the front reinforced with a heavy hardwood plank, such as 5 in. by 3½ in. elm. Into this are driven a number of stout pegs or iron staples in suitable positions and of varying heights by which he can get any purchase he wants, either for straightening or crook bending. Another straightening appliance is merely a notch cut in a stout piece of wood set on end, and at an angle to the worker, in which the stick is inserted at various points where alteration is required, while the eye can glance along it during the operation. When finished it is put on one side to cool, which it should do with little or no tendency to revert to its original shape. A more elaborate method used for better-class sticks, or those made of more stubborn wood, such as holly, oak, hawthorn, etc.), is that of the straightening boards; these are wide and thick pieces of wood, generally beech, with a number of straight grooves of various widths cut in them. The sticks to be straightened are placed in the grooves while hot and pliant, and secured against one side by wedges driven in at intervals and left to dry as fixed. Semi-circular crutches can be bent by immersing the end in boiling water for from 10 to 15 minutes, then bending it to the desired form either by hand or by means of a couple of staples in the bench; the crook is then secured in this position either with a tourniquet or by being placed on the bench with small pieces of wood nailed down round it.

Apart from the common curved handle, sticks can be bent or twisted by the application of heat when in this pliant state to almost any shape in reason, such as the twists, curls and spirals seen in some fancy sticks; while umbrella and sunshade handles, especially those made of cane or bamboo, are sometimes even tied into knots. After bending, straightening and trimming, the sticks are put into a dry airy place, not too hot, to get thoroughly dry and seasoned. Single sticks may be hung up with a weight on the end to keep them from warping, but the usual practice is to tie a bundle of them tightly together, and they then keep one another straight. The tendency to distortion should not be very great if the straightening has been well done. Some workers hasten this process by carrying a brick flue from their fire up through the loft or other drying place. The sticks must anyway be so arranged that air can get thorough access to them.

Finishing.—The finishing processes vary widely according to the quality of the stick, the purpose for which it is required, and the material of which it is made. They range from no finishing at all beyond perhaps putting on a ferrule, to the most elaborate trimming, smoothing, staining, polishing and carving, according to customers' requirements. One or two of these finishes may be indicated as follows :—

(1) Some sticks (*e.g.* hazel) are merely buffed up with a wax mop to give the bark a natural sort of gloss, and the hook end trimmed up and carefully rounded off and touched up if required with a hard slow-drying varnish.

(2) Elm sticks with the rough bark left on must be trimmed clean round the neck and on the handle or knob, and at the ferrule end for an inch or two, any loose bark on the stem being also cut away. It is then smoothed a little with sand paper, coated with boiled linseed oil and allowed to dry. When dry, the smooth parts should be polished up and the whole varnished with hard varnish—one or two coats as required.

(3) In some cases hazel, ash, holly, birch or apple sticks have only a part of the bark removed and the knots or other protuberances smoothly trimmed down. They are then rubbed over with glass paper, dressed with boiled linseed oil, and dried, polished and varnished as in (2). Hawthorn sticks may be treated in the same way, while oak sticks are best entirely stripped of bark and then treated similarly. The trimming may be done with a spokeshave, a small plane, or a knife.

(4) The forming of handles and knobs must be left to the discretion of the worker; much depends on the natural shape of each stick and the use to which it is to be put. For fancy sticks, the knobs and handles may be elaborately carved, but if for ordinary use, they are better smoothed and rounded to fit comfortably into the hollow of the hand. To the experienced worker the shape of the root in the rough will itself usually suggest the most suitable treatment.

(5) Sticks and umbrella handles are often stained, particularly when they are trimmed smooth all over. This may be done either by putting on the stain hot with a brush, or by immersing the stick in a heated solution; the former is the mode most commonly adopted by the small maker. Staining should be done before the sticks are dressed with linseed oil. Stains in a great variety of tints can be so easily and cheaply purchased with full directions for their use, that it is hardly worth while to describe methods of making them up, but a very good black stain is obtained as follows:—

After smoothing, but before oiling, brush the sticks over with a hot and strong solution of logwood and nutgalls, and when this is quite dry, brush them over again with vinegar or acetic acid, in which a quantity of protosulphate of iron, iron rust, rusty nails or rusty iron filings have been lying for some days. Other methods of colouring may be obtained by adding tinting materials to the polish used, such as dragons' blood, to produce a mahogany colour, or yellow ochre to produce a yellow coloured stick. Further details on these processes can be supplied if desired.

(6) Ferrules can be bought much more cheaply from wholesalers than they can be made, and can be obtained in a variety of sizes and qualities. They should be fixed with two small screws or nails, one on either side, to prevent them falling off, when the stick shrinks in dry weather.

Artificial or Manufactured Sticks.—This section of the industry, although carried on abroad to a considerable extent as a rural one, is perhaps unlikely to interest the small and local worker in this country to any great degree, but the following description is typical of several village factories in Austria and Hungary. Considerable use is made nowadays of machinery and power, and mass production is essential under modern and factory conditions. Large use is made of foreign, and often rare and valuable woods, which are specially imported for the purpose; and instead of the naturally shaped saplings, seasoned timber is mostly used, which is cut up as required, turned or otherwise machined to shape, and bent by machinery. In the manufacture of the higher quality of sticks and parasol handles, workers in gold, silver, precious stones, ivory, etc., are often required as well. There is no doubt, however, that some of the methods in vogue are more or less applicable to the rural worker, who might well devote his attention to making a certain proportion of the so-called artificial sticks with the aid of wood-working machinery of a more or less elaborate kind, according to his circumstances or the volume of his business, and for this reason it is thought that the following brief general outline may usefully be given here.

When green timber is to be employed it is cut into scantling or heavy planks, and then subjected to much the same methods of seasoning as that referred to in the case of natural stick-making, except that it is more common to find artificial means of hastening the process resorted to. The timber now seasoned and dry is cut up into rods of square section, and this cutting is done so as to make the greatest possible use of the run of the grain. Skill and experience are necessary to make a proper selection here, particularly when rare and valuable woods are in question. These rods are from 42 in. to 48 in. in length, and after cutting they are rounded in a special lathe which turns them to the exact shape or taper required.

Various types of lathes are used, such as copying lathes which will turn two or three sticks at a time, working from a rotating metal former. Sometimes what is known as a golf-stick lathe is used: this is rather an expensive and specialised machine, but is in some respects merely a special sort of combination copying and profile lathe. The profile lathe is quite suitable so long as attachments are provided to support the long and slender piece of wood whilst it is being turned. A profile lathe is a copying lathe in which the rotating former is replaced by a fixed metal or hardwood template.

The small worker could quite well use the simple wood turner's lathe with some form of support to prevent the stick being broken or forced out of centres whilst turning. With such a machine, however, the output would not be so great. It is a common, but not invariable, practice to leave the crook end of the stick square or rectangular in section until after bending. Machine bending is done more safely and satisfactorily with the wood in this shape, and the handle can be finished to shape more perfectly afterwards. This shaping is sometimes done by hand-tools, but the rapid method is to use a rotating fly-cutter in the ordinary wood machinists' vertical spindle machine. The cutter is shaped to the quarter of a circle, and by means of jigs the inside and outside of the crook can be shaped in a few seconds. The stick is then turned over and the other side treated the same; the neck piece still remaining of square section between the handle and the stem is then trimmed down with a spokeshave. In the factory these operations are generally done by girls, and the smoothing of the rods, instead of being done by hand, is more rapidly effected on a belt-type sand-papering machine. The softening of the sticks for bending is done by steaming them in a special apparatus supplied with low pressure steam (about 10-20 lb. per sq. in.) from a boiler. This boiler also supplies steam to the staining plant. The steaming drum is used for taking full length sticks, and a steaming box of a different and more compact type may be employed when handles only are being made. Both are arranged to be kept continuously in action, having a number of compartments which can be filled and emptied successively without disturbing the others. The steaming process occupies from 1 to 2 hours, varying with different timbers, and from 10 to 20 dozen sticks or handles can be steamed at a time. The hot and flexible sticks, when ready, are taken to the power-driven bending machine in which they are held by an adjustable cramp with a spring steel strap and bent round a heated circular former of chilled cast iron, which is removed with the stick when bending is completed, and a fresh one inserted ready heated for the next stick to be operated on. The bent stick remains attached to the former by the bending cramp until cold, and the heat remaining in it dries the stick out completely at the same time, without charring the wood at all. The bends take about 1½ to 2 hours to dry and set. The above methods ensure a large and rapid output of uniformly bent handles. This method is chiefly used where handles are separate from the stem, enabling an ivory, galilith or erinoid washer to be inserted between the two for ornamental purposes.

The end is prepared for ferruling by a special rotating cutter rather similar to a spoke trimmer which tapers the end of the stick an exact fit in the ferrule, which is then driven on and stamped in a fly-press to produce two small depressions of the ferrule into the wood to hold it in place; it is seldom that the factory-made stick has the ferrule screwed or nailed.

This description of the manufactured walking-stick industry is intentionally no more than a brief outline. The Bureau, however, would be glad to give information in greater detail to individual inquirers if desired. Application should be made to *The Secretary, Rural Industries Intelligence Bureau, 258/262, Westminster Bridge Road, London, S.E.1.*

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GROWING RED CLOVER SEED IN WALES.

V. S. ELLIS, P.A.S.I., and R. D. WILLIAMS, B.Sc.

FOR many generations two districts in Wales have been famous for their red clover (1) the Vale of Clwyd and extending from Abergele and Rhyl on the coast up to several miles above Ruthin, and (2) that portion of Montgomeryshire extending to a radius of from 10 to 15 miles round Welshpool, and a little over the border of Montgomeryshire into Shropshire in the vicinity of Chirbury.

Experiments conducted at the Welsh Plant Breeding Station, Aberystwyth, with different nationalities and strains of Red Clover and extending over a period of four years, have demonstrated most conclusively that Montgomeryshire Late-flowering Red Clover is very considerably more persistent than any foreign Red Clover. The relative yields during the second harvest year of Montgomeryshire Red, Cornish Marl Red—a strain grown in Cornwall which is very similar to that grown in Montgomeryshire—and some of the most common foreign nationalities are given below:—

Montgomeryshire Late-Flowering Red	100
Cornish Marl Red	100
Canadian	46
Chilian	24
Italian	0

As the experiments on the Vale of Clwyd Red Clover were only commenced in 1922 comparative figures are not yet available.

Similar experiments have also been carried out in the past at the North of Scotland College of Agriculture, and here again Welsh Red Clover has shown excellent results as compared with the other varieties.

The strains grown in the two seed-growing centres in Wales are quite distinct, although both are highly persistent types of the late-flowering red. A broad red type of clover is also grown to a limited extent in the Vale of Clwyd. It has been claimed that this strain is more persistent than the English Broad Red and that it lasts well into the second harvest year. The two late-flowering strains characteristic of Wales may be briefly described as follows:—

Montgomeryshire Red is a very "late-flowering" strain. It is easily distinguished from other strains of "single cuts" by its very dense tufted habit of growth and by its relatively small leaves. The plants are generally sub-prostrate during the early stages of growth. It tillers more freely than any other strain except the Cornish Marl. It does not afford much keep during the winter and early spring, but, though late in commencing active growth, it will usually give a very heavy late hay crop. Its aftermath, as compared with that of English Broad Red or even English Late-flowering Red, is poor. Its outstanding quality is its persistency, and it is therefore pre-eminently suitable for seeds' mixtures intended to be down for three years or more. It is undoubtedly one of the best clover strains for pastures.

Vale of Clwyd Late-flowering Clover is, on the other hand, a medium early "late-flowering" strain. It is usually sub-prostrate to semi-erect in habit of growth. The leaves are appreciably larger than those of Montgomeryshire Red. It tillers freely but not so much so as the Montgomeryshire strain. It yields, however, better grazing during the winter and spring, and gives an earlier hay crop and more aftermath. A high degree of persistency is claimed for this strain, but it is not such a good plant for grazing purposes as the other Welsh strain.

As the superiority of Welsh Red Clover over other strains for lasting into the third and fourth years and for its hardiness has been clearly demonstrated, steps have been taken with the object of fostering the growing of this seed and of improving the facilities for cleaning and marketing.

With this end in view two conferences were convened last year at Welshpool and Denbigh, in the respective areas in which this seed is grown, and were attended by all the principal growers in the districts. As a result of these conferences a subsequent meeting of growers took place at Denbigh last September when an Association was formed and called the "Vale of Clwyd Red Clover Growers' Association," and last January a similar Association was formed at Welshpool to be known as the Montgomeryshire Welsh Red Clover Seed Growers' Association. Similar rules and regulations, providing for the certification of the true strains and the testing of the seed under the Seeds Act, 1920, were drawn up by each Association.

Although the quantity of seed available each year will vary in amount owing to the uncertain climatic conditions existing in Wales there is no reason why the acreage at present under these clovers should not be considerably increased as the excellent qualities of the seed become more extensively known.

A good deal still requires to be done in the way of improving facilities for cleaning, and, what is even more important, the earlier threshing of the seed so that it can be cleaned, tested and placed on the market at the commencement of the following seed season.

If the growers will only now seize their opportunity and give their whole-hearted support to the two new Associations formed there appears to be no reason why in a few years' time the true strains of Welsh Red Clover should not have a world-wide reputation.

It also is interesting to note that at a meeting of the Committee of "The Vale of Clwyd Association, held at Denbigh on 27th June, it was decided:—

(1) To appoint a qualified botanist for the purpose of inspecting the clover fields so that the true strain could be certified; and

(2) To concentrate on the development of the permanent late-flowering Red.

The Secretary of the Vale of Clwyd Society is Mr. Arthur E. Roberts, 131, High Street, Rhyl, and of the Montgomeryshire Society, Mr. Havercroft Jones, Wesley Street, Newtown, N. Wales, to whom all inquiries regarding the purchase of this seed should be sent.

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GARLIC-SCENTED PENNYCRESS: A WEED NEW TO BRITAIN.

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South-Eastern Agricultural College, Wye.

GARLIC-SCENTED Pennycress (*Thlaspi alliaceum*) is an annual plant closely related to the Pennycress (*Thlaspi arvense*) already familiar to farmers as a weed of arable land. Examination of a weed-infested arable field in the neighbourhood of Hothfield, near Ashford, Kent, in May, 1923, led to the discovery that Garlic-scented Pennycress was present in abundance. This plant, a native of south Europe, does not appear to have been previously recorded as a weed in Great Britain. The area infested was 15 acres farmed under the Norfolk four-course rotation. The crop taken in 1922 was wheat in which the weed occurred sparingly, but owing to continued wet weather in autumn and spring, the soil, a heavy clay, was unworkable and weeds consequently covered the stubble. The plants on the field were so numerous in May, as to resemble a crop being grown for seed. The average height was approximately two feet.

Description.—Individual plants show erect habit of growth; the majority have four to ten branches arising from close to soil level and occupying considerable space (Fig. 1). The whole plant is free from hairs, and when bruised emits a strong garlic—or onion-like smell. The lower leaves clasp the stem and the upper are provided with short stalks, though on the mature plant the majority have usually withered or fallen. The flowers are white, small and inconspicuous. The fruits or pods are borne on slender stalks in great numbers on all the stems, and their edges are flattened to form a narrow rim or "wing" which is notched at the top. They differ from those of Pennycress in that the latter are longer, broader, and are provided with a larger "wing." The difference in shape of the pods and of their central membranous partitions is shown in Fig. 3.

To each side of the membranous partition within the fruit, three or four reddish brown seeds are attached; these can easily be observed if the two "valves" of the fruit be removed. Fruits of common Pennycress contain seeds of much the same colour and size* as those of Garlic-scented Pennycress, but in greater numbers and having the seed coat marked with very conspicuous ridges which are approximately parallel to the outline of the seed. The seed coat in the case of *Thlaspi alliaceum* is ridged, but less conspicuously, and the ridges themselves are pitted throughout their entire length (Fig. 2). The fruits and seeds ripen at the middle or end of May.

Origin.—As already indicated, this weed is a native of south Europe, where it appears to be of general distribution. Specimens in the European Herbarium of the British Museum are labelled as follows:—Stiria. Salzburg, Loire Inférieure, Piedmont, Italy, Sicily, Croatia, and descriptions in Continental Floras† indicate that in addition to the above, it is found in Spain and Rumania.

It is of interest to note that in the British Herbarium, at the British Museum, there is one specimen with incomplete description, presumably collected in Britain. This was origin-

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* The average size of the seed is 1·8 mm. × 1·3 mm.

† *France*: Rouy et Foucard II, 146, Flore de France, 1895.
Italy: Parlatore, Filippo, IX, 694, Flora Italiana, 1890-93.
Spain: Willkomm et Lange III, 776, Prodomus Florae Hispanicae, 1880.

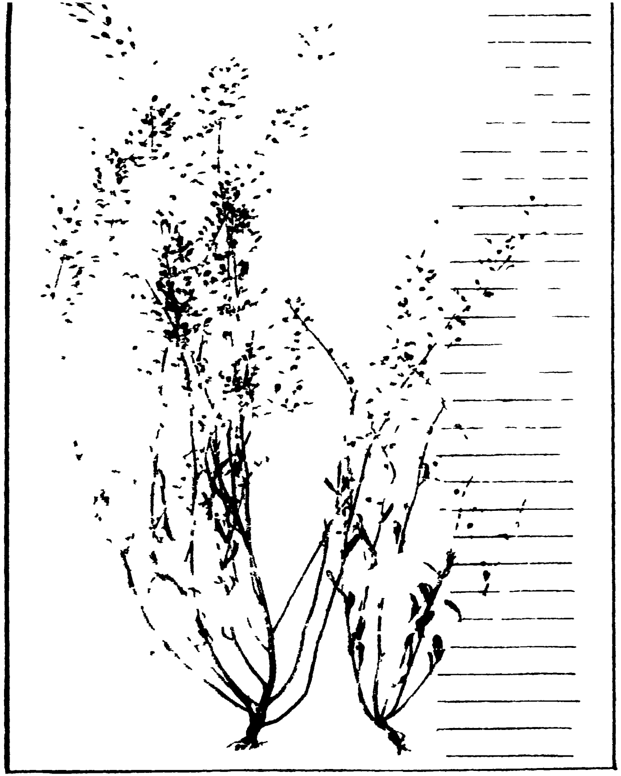

FIG. 1.—*Thlaspi alliaceum*. Garlic-scented Pennycress. (The height of the weed in inches is shown by the lines on the right.)

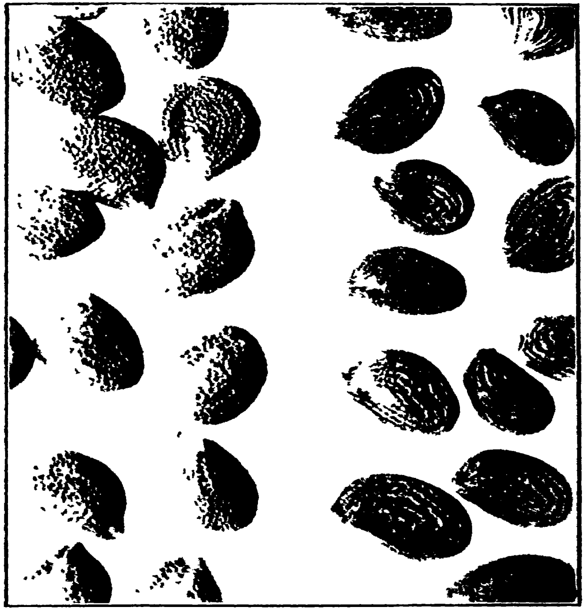

FIG. 2.—*Left*, seeds of *Thlaspi alliaceum*.
Right, seeds of *Thlaspi arvense* (Pennycress.)
All × 10.

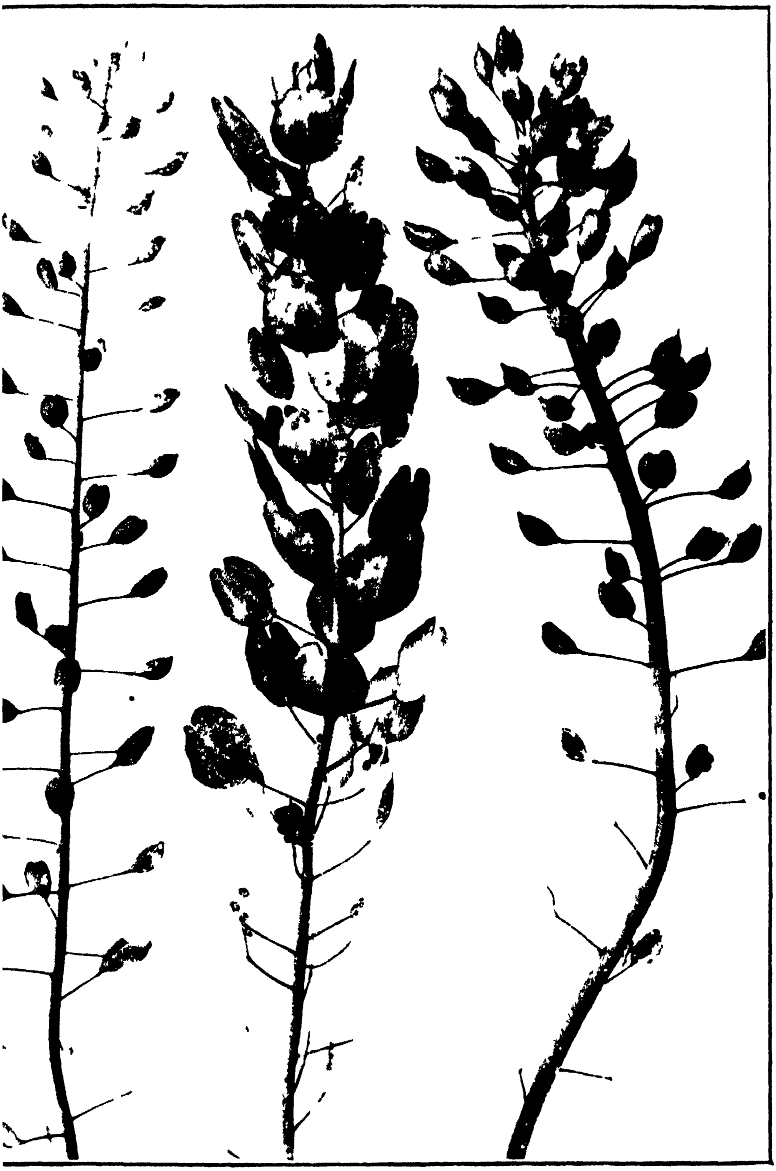

FIG. 3 —*Left and right* mature fruit pods of *Thlaspi alliaceum.*
Centre mature fruit pods *Thlaspi arvense.*
Natural size

ally in the Lightfoot Herbarium and is therefore approximately 150 years old. *Thlaspi alliaceum* is mentioned by J. C. Loudon in his Hortus Britannicus, 1832, and in connection with this plant, under the heading of "Year of introduction of Exotics," appears the date 1714, though no other particulars of its occurrence in Britain are detailed in this or later editions of his work.

Occurrence on Arable Land.—Reference to the labels of the Herbarium specimens mentioned above, shows that this plant is a weed of arable land on the Continent, being found in crops of cereals and of lucerne. It has been reported in one instance in Italy as constituting a large proportion of the fodder fed to certain oxen which had suffered in consequence, and from information in the Floras mentioned above, it would appear to be widely distributed, being found in vineyards, fields, hedges, woods and grassy places. It is described by Woods* as occurring in arable fields of mid and south Europe.

It has probably been introduced to England as an impurity in some such seed as that of lucerne or red clover, but the farmer at Hothfield could give no exact information on this point; he stated, however, that he had observed the weed for many years.

Harmful Properties.—When once allowed to ripen and shed seed, it is evident that this weed can do considerable harm, either by necessitating increased cultivations to eradicate the seedling plants or by its smothering effect on crop plants if allowed to grow to maturity. In the latter event the seeds are ripened early, and in most cases will be shed before the weed can be removed with the crop, thereby increasing the infestation in the following year. The soil of the field under observation was so thickly coated with the seeds that in places it assumed a reddish brown colour. Samples of the soil, removed to the laboratory, were dried and crushed, with the object of carrying out an estimation of the seeds they contained. The soil had a strong odour of garlic

Some idea of the number of seeds deposited in the soil was obtained by counting the plants on measured areas,† the average number of pods per plant,‡ and seeds per pod.§ This amounted to 79,768 seeds per square yard.

More direct harmful properties may be attributed to this plant. In May, 1917, a case of poisoning of oxen is recorded by Beguinot,* in Italy. Of 40 poisoned animals, 8 had died and their fresh-cut fodder, when examined, was found to consist largely of *Thlaspi alliaceum.* No other cause of poisoning or death was found, and the author advises that neither this species nor ordinary Pennycress (*Thlaspi arvense*), should be allowed as an impurity in fodder. It is further stated to cause tainting of milk if eaten by cows. In connection with this, it is of interest to note that Pennycress (*Thlaspi arvense*) is known in Canada as "Stinkweed," though not possessed of such a strong odour as that characteristic of *Thlaspi alliaceum.*

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* Joseph Woods, Tourist's Flora, 1850.

† Average 13 plants per square yard.

‡ Average 767 pods per plant.

§ Average 8 seeds per pod.

Eradication.—Garlic-scented Pennycress being an annual, and propagated entirely by seeds, must be dealt with before the fruits have ripened. Harrowing and subsequent hoeing should be practised, as in the case of charlock, until the plant is in flower. After this stage it is advisable to hand-pull and burn, care being taken that no plants with immature pods are left to be ploughed in, as it is quite possible that such fruits may ripen seed below the soil. Unless such measures are adopted, the land will become infested with the seeds as above described. In the case under consideration the farmer has repeatedly noticed that when a cereal crop was being taken a heavy seeding invariably resulted in partial suppression of the weed.

Under normal conditions, *i.e.*, when cultivations are not adversely affected by the weather, there is no excuse for its becoming a pest, and there seems no doubt that this weed can be effectively controlled.

The writers desire to express their thanks to the Director, Royal Botanic Gardens, Kew, for identification of the plant. They are also indebted to the following gentlemen for information kindly supplied: Mr. C. B. Saunders, Chief Officer of the Official Seed Testing Station, Cambridge, Mr. A. J. Wilmott, British Museum (Natural History), London, and Mr. H. C. Long, Ministry of Agriculture.

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* Augusto Beguinot, in Atti dell' Accademia Veneto-Trentino-Istriano, Vol. X, pp. 99-110. Padua, 1917.
Abstract in International Review of the Science and Practice of Agriculture. Year IX, No. 6. Rome, June, 1918.

POULTRY-KEEPING AND FRUIT CULTURE.

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THE advantages of running poultry under fruit trees are becoming more generally recognised and the practice is spreading rapidly, especially in Cambridgeshire. From the point of view of the poultry keeper, the rent of the land is paid by the fruit, and ample space together with a generous supply of insect life is obtainable free of cost. Further, an immediate use is found for the manure without any trouble of storage or transport. If the advantages from the poultry keepers' point of view are great, those secured by the fruit grower are even greater. A great part of the expenditure on labour and material required for spraying the trees and manuring and cultivating the land is saved.

Many of the principal insect pests of fruit spend much of their time on or in the soil, and it is at these times that they are caught and consumed by poultry. All kinds of caterpillars, maggots, aphides, and even weevils, are readily devoured. Some of the worst pests of fruit, such as weevils, pear midge, maggots, etc., are more effectively dealt with in this way than in any other. In addition, the land can be cleared of such harmful insects as leather jackets, wireworms and ants (which are so active in spreading the dreaded purple aphis).

Organic manure is a source of expense and difficulty to the fruit grower and this can be largely supplied by poultry. Many fruit plantations are so starved that only small crops of poor fruit are obtained, and an immediate improvement would result by the introduction of poultry. A number of instances are to be seen of the effect of the poultry running in the orchards as against orchards on adjoining land not so stocked. The greater vigour of the trees in the former case seems to enable them to withstand frosts and attacks of disease, which have this year done much damage. Successions of good crops are reported from plums, and there is little doubt that for increasing the size of the fruit, poultry manure is unsurpassed.

The cultivation of the land in fruit plantations is another expensive item, and this can be done either wholly or in part by poultry. With bush fruit and young apple, pear and plum trees up to five or six years old, it is essential to keep the land cultivated, but the amount of cultivation required will be considerably lessened by poultry With older trees, however, no cultivation is necessary. Two hundred hens per acre will keep the land clean. One hundred hens per acre will largely keep down grass, etc., and will secure the high colour of apples without the reduced size generally associated with grass orchards.

Various methods of combining poultry keeping with fruit culture have been adopted by different growers with success, and a brief description of these is now given.

Mr. J. G. Faircliffe, of Burwell, Cambs, has run poultry under fruit trees for twenty years in the orchards (extending to some 50 acres) of Mr. R. Stephenson at Exning. He also has a younger plantation of about 5 acres of his own at Burwell, where he puts into practice his latest ideas. At first large houses placed at one end of large enclosures were made. In his experience, however, the poultry only worked near the houses, and the size of both pens and houses has therefore been reduced and the houses placed in the centres of the pens. At Exning the pens are now five to the acre and each holds 2 dozen laying hens. At Burwell the pens are 15 to the acre and each holds 10 hens. In either case sufficient pens are reserved for chicken rearing. Light breeds were preferred at first as they work more ground, but it was found that they will get up into bush apple trees and strip them of fruit when half grown. The light breeds have therefore been abandoned in favour of White Wyandottes and Rhode Island Reds. Runner ducks have been found to improve rough ground more quickly, but this advantage is considered to be outweighed by their failure to lay when checked by a cold snap in winter or otherwise upset. The trees at Burwell are twelve to fourteen years old. They have had poultry amongst them for seven years and have carried five or six consecutive heavy crops. No spraying has been necessary, and what may be considered proof that the poultry deal effectively with the pests is to be seen in the actual presence of only small numbers of the various caterpillars, blue and green aphis, apple blossom weevil, etc., which in a season such as this would have increased largely but for the activities of the fowls.

Mr. T. H. Langan, Willingham, has run poultry under his fruit trees for several years. He states that a plantation of Victoria plums in the fen district had never produced anything but " skin and bone " until he put in poultry. Last year he secured a first-class sample of large plums and this year it has one of the few crops in the district. At another orchard half acre pens were made and an intensive house with 100 hens was put in each last September. Mr. Langan is now trying a plot of several acres with a large house in each corner. At the blossoming period, the apple trees around the pens were very forward in leaf and blossom. while those further away were rather weak and backward. The large amount of ground worked by Anconas—much larger than Leghorns or any heavy birds—was very marked. Mr. Langan has 2,000 layers and has recently installed a Mammoth incubator with capacity for 4,000 eggs and a plant capable of rearing 6,000 chickens. He intends to increase his hatching capacity very largely next year.

Messrs. Chivers & Sons carry on their various farms a large head of poultry, consisting of Light Sussex, White Leghorn and White Wyandotte; the first breed is much favoured. The main poultry operations are centred at one farm under the charge of an experienced poultry man with four assistants. The stock are bred and the chickens hatched and reared in the early stages at this farm. The total incubator capacity is about 7,500. The breeding stock is trap nested and very carefully selected, and good laying strains of all varieties have been established. The young stock are drafted out at 8 to 12 weeks of age, and later some of the best pullets are brought back to the poultry farm into large flock houses and trap nested. In the extensions now anticipated, the laying flocks will be in units of 350 with approximately 140 birds to the acre.

The pens vary considerably in size from ½ acre up to 2½ acres, but in most cases the land is kept cultivated. In some cases the trees are widely planted and there are two runs to each house—one growing a crop of greenstuff, while the other accommodates the poultry. This system both provides greenstuff for the poultry and prevents the land becoming foul. Where the trees are planted at the usual distances, greenstuff is not grown, but is supplied to the birds from other land, and the fruit land is kept cultivated. Chicks in the early stages are run on grass under the trees.

The stocks of poultry, which are pure bred and of good strain, are particularly vigorous and healthy. The conditions, which afford ample range and every inducement to exercise, lead to vitality and good results in breeding and rearing. Although it is sometimes stated that laying hens do less well under trees during the autumn and winter months than under more open conditions, there is no evidence to prove that this has any effect in checking egg production. The returns reported during these months are very satisfactory, and it is probable that the shelter which is afforded in the orchards from the north and east winds is a set-off against damp during the rainy season. The benefit of the shelter from sun during the summer months is a very distinct asset to all the stock, particularly to the young birds.

No general system of housing is followed by the different breeders. Scratching sheds of large type and smaller colony houses are used for the laying birds. Although the provision of scratching sheds may appear to some extent to defeat the object of keeping the poultry to benefit the orchards, in that they would roam less, there is no doubt that with large flocks, scratching accommodation is a wise provision. It is unnecessary, however, where the flock unit only amounts to ten or twelve birds.

It is probable that, as claimed in one instance, the small flock is preferable from the point of view of poultry production as well as for the sake of the orchard, where operations are upon a small scale. Upon a larger scale, however, the additional supervision of employed labour, the extra labour required, and the additional cost of equipment, are all in favour of larger flocks.

In the same way in the feeding of wet and dry mash, both of which are practised, the latter system is of great advantage to the fruit grower whose orchards are frequently at some distance apart, even if the results from the poultry should be less good. The preparation and distribution of wet mash under these circumstances adds considerably to the labour. Feeding costs are, however, frequently cheapened by the use of surplus potatoes, and this necessitates a wet mash. It is worthy of note that the ration of animal food in the mash fed to fowls is considerably reduced during the periods of cultivation.

The capacity of a fruit grower for long and irregular hours of work and his essentially practical and observant nature, make him particularly adaptable for the successful management of poultry. The fact that both poultry and fruit trees require constant attention is an added advantage, as when run in conjunction, important details in management do not long escape attention.

A method advocated by one of the pioneers in this area for establishing a new orchard, is to plant small fruit between the young trees. The returns from the small fruit meet all expenses in the first few years, after which poultry are turned in as the trees commence to come into profit. During the ripe fruit season, poultry would be likely to damage small fruit, and they should be removed to other quarters at this time.

There are still many established orchards which would benefit largely if stocked with poultry, but the cost of equipment is a consideration, since a good deal of wire netting is required. It is generally found, however, that 5 ft. netting is sufficient for any purpose, and in some cases 4 ft. netting is used where only heavy breeds are kept. Bad fruit seasons, however, are those in which more attention is called to the value of the poultry in controlling the many pests to which fruit trees are subject.

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LAVENDER: ITS CULTIVATION FOR MARKETING AND DISTILLING.

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Ministry of Agriculture and Fisheries.

LAVENDER has been grown commercially in the south of England for a great many years, having been introduced in 1568, and where the soil and situation are favourable, there is no doubt that it is a profitable crop and worthy of consideration. Lavender is grown for sale in a fresh state as "bunched lavender," for sale as "dried lavender" for sachet making, etc., and for the production of oil of lavender for perfumery purposes. As regards oil production it is pointed out that chemistry has not yet succeeded in producing a synthetic product which can claim to be a substitute for English Oil of Lavender, and hence the supply depends wholly upon the natural product. The variety grown, and which should be grown, commercially in England is *Lavendula vera*, of which several strains exist, and usually referred to as "English" lavender. The chief lavender growing districts in the past have been in the neighbourhood of Mitcham, Hitchin, Canterbury and Bournemouth, the Mitcham oil of lavender having become world famous as a product unequalled by that of any other country.

Soil and Situation.—Too much stress cannot be laid on the importance of soil and situation. These are the factors governing success, and should be carefully considered before steps are taken to plant any large area. In common with all plants containing a high percentage of oily matter, lavender needs very little moisture and does best in a calcareous, stony, well-drained soil in dry sunny situations. The ideal soil is a light brown loam overlying chalk, although sandy loams, provided good dressings of chalk or lime are applied, may be utilised. Heavy soils which hold water are not suitable.

Situation is quite as important as the soil, if not more so. Lavender is by nature a sub-tropical plant, although fond of high altitudes. It is liable to injury by frost and hence low-lying situations and those prone to become weather-bound in winter should be avoided. Even under favourable conditions in England a hard winter may result in a number of plants being killed by frost. The situation should be exposed and sunny, preferably sloping to the south, and protected, if possible, from the prevailing summer winds by a belt of trees or a high hedge. This matter of protection is important, as considerable damage may be done by high winds when the tall flower spikes are being carried by the plants during July and August.

Preparation and Cultivation of the Land.—It is supremely important that the land be properly prepared by deep and thorough cultivation. Potatoes which have been well manured make an excellent forecrop, as the thorough working of the land will prepare the way for the lavender.

After planting it is essential to keep the land in a thorough state of cultivation while the plants occupy it in order to secure a good annual throw of bloom. If possible a horse-hoe should be used for this purpose and the land worked both ways and as close to the plants as possible.

Plants and Planting.—The plan most favoured after a supply of plants is secured is to plant them out 18 in. × 18 in. very carefully on the square. When these plants have occupied the ground for one year, each intervening plant and those of every other row are taken out, leaving the land planted 36 in. × 36 in. The plants so removed will be utilised for planting up fresh ground, each being divided into about three. Before being planted the plants should be trimmed at the top and the rough roots removed to where the fibrous roots have developed. The usual practice is to use a straight chopper and clean wood block for preparing the plants for replanting.

Planting should be done in October or early spring. November and the winter months should be avoided, as the plants are then liable to injury by frost and snow when out of the ground. It is important to plant very deeply. Special dibbers are used not less than 14 in. long, and the plants should go into the ground up to within 2 in. of the top and be very firmly closed in.

In commercial practice the bushes are seldom retained after their fifth year, after which they should be grubbed and burnt. It follows, therefore, that in order to keep up a continuous supply of bushes in their prime, planting and grubbing must, in an *established* plantation, be done every year. Most growers plant, say, a fifth portion of the ultimate area of lavender aimed at in the first instance and this is repeated each year until the fifth year, when the area first planted is grubbed immediately after flowering and the land fallowed. It is an advantage to have a sixth piece of land available for planting in the fifth year in order to give the land, which has carried lavender for five years, one complete year's rest from the crop. During the first year in the permanent position the plants are better for not being allowed to flower but should be kept trimmed with a pair of sheep shears to promote bushiness.

Marketing the Crop.—The lavender is ready for market when the middle blossoms of the spike are widely open; the lower blossoms will then be fertilised and the top blossoms showing the bloom of the bud. When sold as bunched fresh lavender the stalks must be cut as long as possible, cutting well into the bush (this also serving the purpose of cutting back the bush at one operation). The cutting is done by a small sickle having a toothed edge, and should be done as late in the evening as is compatible with despatch for market. Bunches for market are about 12 in. in diameter, tied with raffia as low as possible to the butts. Six of these bunches are tied together in bundles.

When sold as dried lavender the flowers are dried on the stalk and are subsequently removed by hand or with the aid of a sieve. There is a considerable loss of weight during the drying process and only about a fifth of the weight of fresh flowers will be available as the dried product. The lavender is dried by being spread out thinly on shelves in a dry shed for about six weeks.

Distilling.—The founding of a lavender plantation for the purpose of oil production is an enterprise which requires careful consideration beforehand. It will be necessary to provide a small distilling plant on the grower's premises unless arrangements can be made for the distillation of his crop at a local distillery.

Beyond reference to the facts that the still should be of the shallow body type and be worked by steam from a boiler the technique of distilling cannot be discussed here. ■

When cutting for distilling, the blooms must all be fully out, generally about a week later than for market. The cutting should only be done in the sunshine, the cut laid on clean dry mats, and covered from sun scorch immediately. There must be no moisture in the stook, neither must it be dried up by wind or sun. The mats will be rolled up in the cool of the evening before the dew is falling and carted to the still.

For some purposes the stalks are shortened to about 6 in. before stilling, but generally the whole of the contents of the mat are placed carefully in the still right away.

The grower carts his own lavender to the still, if he possesses no distilling plant of his own, and superintends the boiling and watches for the "Oil-run."

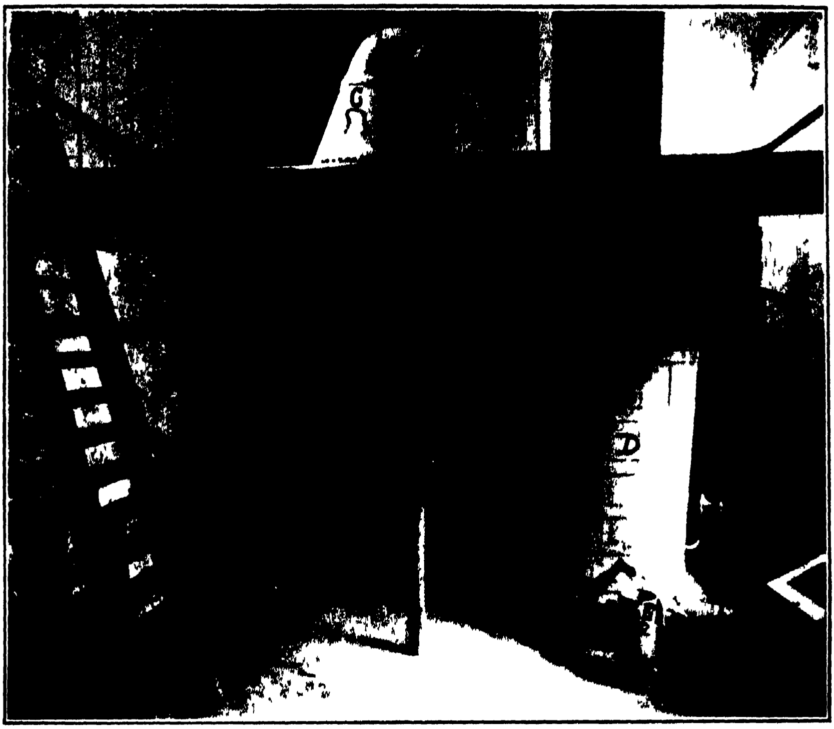
The yield of oil is apt to vary considerably from season to season, as the age of the bushes and the weather will affect both the quantity and quality of the product.

Roughly speaking, 1 cwt. of fresh flowers with six inches of stalk will yield about 10 oz. of oil. An acre of lavender in its prime would in a favourable year yield from 15 to 20 lb. of oil, but taking the whole of the area planted as directed above an average yield of 12 lb. to the acre would be a fair estimate. The market value of the oil is constantly fluctuating and its use in perfumery is influenced considerably by the price of alcohol. It is a noteworthy fact that English oil of lavender enjoys a very much higher value than imported oils.

After distillation the oil is matured in the dark, for from 3 to 5 years, stored in blue glass jars known as "Winchesters" holding about 80 oz., but as this is usually done by the merchants it does not concern the grower, unless he elects to store and mature his own oil.

Lavender Disease and Pests.—Lavender is unfortunately often severely attacked in this country by a fungus disease known as "shab" or "wilt," which is caused by the fungus *Phoma lavendulae*. The disease causes wilting or shrivelling of the growths and bushes attacked soon die.

This disease is under investigation at the present time, and at the moment little can be said definitely as to preventive measures. Care should be taken to obtain healthy stocks for planting, and if the disease appears in the plantation all affected portions of bushes and dead bushes should be removed and burnt as soon as detected.



(A) Charge Chamber; (B) Steam Jacket; (C) Goose Neck; (D) Condenser; (E) Receiver.

Although a few growers have installed up-to-date cohobation stills, those usually employed are of simple construction, any fault in the distillate being subsequently rectified by fractional distillation.

The stills are constructed of copper, and generally built to take a charge of about 5 cwt. of flowers at a time. It is important to avoid burning, and the practice is to provide the stills with two chambers, with a perforated false bottom between, the lower chamber being filled with water, which should be as soft as possible.

Distillation is conducted by boiling the water beneath the charge with steam brought from a boiler to a coil, the top of which must be at least 1 ft. beneath the bottom of the charge chamber. The application of direct heat should be avoided. The oil flow from the condenser must be watched for, and complete distillation of the charge usually takes about 6 hours from the commencement of the flow.

On badly drained soils and soils with a deficiency of lime or chalk the roots of the bushes are often attacked by the mycelium of a fungus which penetrates to the main stems and ultimately causes their death.

The exact nature of this disease is obscure but it appears to depend very largely on soil conditions and is not very troublesome where the latter are favourable to the lavender.

No insect or other pests are known to attack lavender to any extent, but slugs often cause damage by eating away the young growths in the early summer.

* * * * * *

PAYMENTS IN KIND TO THE FARM WORKER.

UNDER varying names, such as " privileges," " perquisites," " extras," " gains," or " allowances," the old custom of making payment for services partly in kind instead of wholly in cash, continues to find favour amongst certain sections of the agricultural community in England and Wales.

The system can be traced back to early times when virgators and cottiers had by law to perform certain labour dues for their lords, for which, it is recorded in the thirteenth century, they " received a considerable part of their income in kind." By the sixteenth century the custom had further developed, and farm servants, and even in some instances day labourers, were allowed to board in the farmhouse, the provision of meals being reckoned as part payment of the worker's wage. Other allowances were frequently given, such as a house and garden, fuel, and especially beer and cider. The system of giving payment in kind gradually decayed, however, towards the end of the eighteenth century. Various causes led to a slow but general development which, with the exception of Northumberland and Westmorland, affected the whole of England and Wales, and by which farm servants were put as far as possible on money wages.

The general economic depression of the early part of the nineteenth century was doubtless considerably relieved by the provision of allotments as part payment. The provision of gardens followed and the tendency towards the payment of wages in kind, but on a more generous scale, was renewed. The Truck Act of 1831, which legislated for the prohibition of the payment of wages in goods or in kind to workers in certain industries, specifically excluded servants in husbandry from its scope. The system was, no doubt, distinctly beneficial to the workers during the periods of high prices, but as it extended it became open to abuse by unscrupulous employers, and protests were frequent. By the Truck Act of 1887 it was made illegal to contract with a servant in husbandry for giving him intoxicating drink in addition to money wages as a remuneration for his services. This practice, even at the present time. is not extinct, although the custom has generally, except in the cider counties, given way to the payment of "beer money."

During the 10 years 1881-1891 there appears to have been a change for the better in the general conditions of agricultural labourers, partly owing to the increasing tendency to pay wages in money rather than in kind. By 1892 the majority of labourers in the low wage districts had allotments where they had not gardens. Lord Ernle wrote of 1888 that "few cases remain in which the want is not supplied." He estimated that three-fourths of the agricultural labourers, farm servants and cottagers in England and Wales had potato grounds, cow-runs, or field or garden allotments. Housing conditions were also reported to have improved.

From Mr. Wilson Fox's Report* relating to conditions in 1898 (issued in 1900), it is fairly clear that while the old abuses of the payment-in-kind system had been remedied to quite an extensive degree under the growing demands for payment in cash, the old customs were still largely practised and were dying very hard. In the northern counties the living-in system prevailed amongst married men, and most of the single men lodged and boarded in the farmhouses, frequently receiving as many as five meals a day. Breakfast. dinner and supper were the usual meals, but during harvest light refreshments, such as tea, coffee, milk, bread and cheese, and cake. known as "ten o'clocks," and "four o'clocks." or "lunches" and "drinkings" were provided, and after a few years it became a general practice to give them all the year round. In Yorkshire a similar position was found, the unmarried hired men usually being lodged and boarded ("meated") in the farmhouses or in the houses of the married foremen. The part of their wages due to them in cash was frequently advanced during the term as required and the balance settled on the expiration of the contract. Ordinary labourers received free cottages and potatoes and straw, and coals were carted and in some cases provided free. Northumberland farmers frequently kept a cow for a worker for about 3s. per week.

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* Report on Wages and Earnings of Agricultural Labourers. Cd. 346.

The living-in custom prevailed in other areas: Cheshire, Derbyshire, the western side of Herefordshire, Monmouthshire, Shropshire, and Staffordshire, and occasionally in Cornwall, Devonshire and Rutland. although it is pointed out that the practice was rapidly declining in some of these areas. In Wales the greater number of farm workers lodged in the farmhouses or in adjacent outbuildings, or boarded in the farmhouse. The precise methods of providing food and lodging to workers lodging with the farm foreman in Yorkshire and in other areas where the custom existed (North Cambridgeshire, Lincolnshire, Nottingham and Rutland) varied in different counties. Sometimes the men bought their own food, which was cooked by the foreman's wife, while in other cases the foreman received extra wages from the employer or a supply of food such as pork, potatoes, vegetables, eggs, meal. wheat and fuel. The payment in kind to " confined men " in Lincolnshire and to married men in North Cambridgeshire and parts of Nottinghamshire included 20 to 30 stones of pork. several sacks of wheat or flour, and 40 to 60 stones of potatoes in addition to house and garden and the usual benefits. In the south the benefits provided to ordinary labourers were on a less lavish scale. They consisted of the provision of cottages, free or at a low rental, frequently with small gardens, rough firing or fuel carted free, milk, straw for pigs, sometimes potato ground, or potatoes, and despite the passing of the Truck Act, beer or cider, especially during hay and corn harvest. Food also was provided during the special seasons. The custom of giving Michaelmas money (which has since been ruled to be deferred payment of wages) was also largely practised.

In his second report,* which appeared in 1905 and relates to the year 1902, Mr. Wilson Fox gives tables of the average weekly earnings of agricultural labourers. The author states that " the figures now published for 1902 substantially apply to the years 1903 and 1904." An analysis of the figures shows that the value of payments in kind to farm workers in the south of England ranged up to one-fifth of the total wages. The Board of Trade inquiry† of 1907, dealing with the whole country, shows a greatly reduced proportion. while the figures obtained as the result of the Board of Agriculture inquiry of 1912 suggest a further decrease. In the *Labour Gazette*, July, 1917, reference is made to the Board of Trade figures of 1907, and it is stated that "so far as the Department is aware, the extra earnings (payment in kind, piece work, seasonal payments, etc.) had not varied to any appreciable extent up to the outbreak of war, although their value has probably increased appreciably at the present time."

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* Cd. 2376.

† Earnings and Hours of Labour.

This was the position when the Agricultural Wages Board was set up under the Corn Production Act of 1917. Unlike the Trade Boards Act of 1909, which made it obligatory on employers to pay the minimum rates fixed by the Board in cash clear of all deductions, the Corn Production Act empowered the Wages Board "to define the benefits and advantages which should be reckoned as part payment of wages in lieu of payment in cash and to fix valuations for such benefits."

Investigators reported very fully on the various practices of giving payment in kind, and showed fairly conclusively that the custom throughout the country had not appreciably changed since the investigation of 1898. In the northern counties and in Wales board and lodging were provided to yearly or half-yearly workers, either in the farmhouse or in the house of the farm foreman. It was found that the most common allowance was a cottage given either rent free or at a low customary rent ranging from 1s. to 3s. per week. The provision of potatoes or potato ground was also extensively practised. In most counties it was customary either to cart coal free from the pit or station or to allow the labourers to use the farmer's cart for carrying the coal in their own time. On colliery farms and in mining districts coal was provided or sold at a small cost, while in Lincolnshire it was reported that coal was given instead of beer at harvest or instead of potatoes. In some areas wood for fuel was given free or hauled free, and labourers in some districts were allowed to collect as much firing as they needed from the coppices and woods. Milk was nearly always given to cowmen and often to other workers. Manure was often allowed to labourers for their gardens or allotments. Bacon and pork were still given freely in Lincolnshire, the East Riding of Yorkshire and Nottinghamshire.

Amongst other allowances given at the time of the inquiry were extra food at harvest or at Christmas, joints when stock-killing, beer or cider (not frequent), rabbits for the catching, and vegetables. Sometimes a worker was allowed to plough his holding or allotment in his employer's time, while the keeping of an animal for the use of stockmen was not an infrequent custom.

The Wages Board set up two committees: (1) A Cottages Committee, to consider the relation of the value of a cottage provided by the employer in connection with the payment of a minimum wage, and (2) an Allowances Committee, to consider and report what allowances (if any) should be recognised by the Board as benefits which might be reckoned in part payment of wages, and the maximum amount of any deduction in respect of their provision.

On the recommendation of the Cottages Committee the Board decided that a cottage should be recognised as part payment of wages, but that the deduction from the cash wage in respect of the provision of a cottage should not exceed 3s. per week inclusive of rates. In a few areas the maximum valuation for the purpose was reduced to 2s. 6d. or 2s.

The Allowances Committee finally recommended that in addition to a cottage, the provision of board, lodging, milk and potatoes, should also be recognised, the value of any farm produce to be reckoned at the wholesale price in the district. After prolonged discussion the Board accepted the Committee's proposals. Representations were made for the inclusion of potato ground, but it was argued that in view of the complications which would arise in the calculation of the value of any ground (being dependent on the soil, the amount of labour expended, the seeds, and the manure), it would be almost impossible to make any reliable valuation except by dealing with each case individually Allowances of wood and fuel similarly did not present easy means of assessment and were precluded. The question of the supply of meals and board and lodging raised similar administrative obstacles, but it was realised that the protection afforded by the minimum wage could be weakened and perhaps nullified by the payment of full cash wages and the subsequent deduction of a disproportionate sum for these provisions, and it was therefore decided to recognise the provision of meals and lodging. With regard to the use or grant of stock or the provision of farm grazing, byre room or food for stock, the Board held, despite several objections from the District Committees, that it would not be desirable to include such provisions as recognised benefits, but it was pointed out that there would be no objection to an employer continuing the practice of providing the worker with a cow or sheep or accommodation or food for stock by making an arrangement (apart from the payment of minimum rates in full) for the worker to pay for the use of stock at the value at which it had been customarily reckoned for that purpose. The custom particularly prevalent in Lincolnshire of supplying bacon or pork could not be recognised, being generally, like potato ground, a deferred and uncertain payment.

It eventually became necessary for the Wages Board to ignore the supply of unrecognised benefits and to insist strictly on payment of wages either wholly in cash or partly in cash and partly by the provision of the recognised allowances of board, lodging, cottage, milk or potatoes, valued at the rates fixed by the Board. This policy probably removed almost all the opportunities of abuse which had existed under the system of giving payment in kind. The system itself was regularised, and the workers were assured of a definite cash wage, the only deductions from which were in respect of certain specified benefits reckoned at fixed valuations.

Had the Wages Board been without power of legislation in respect of benefits and advantages it is probable that the increased value of remuneration in kind during the war would have led to a greater demand for allowances. The action of the Wages Board in confining the benefits which could be legally reckoned as part payment of minimum wages to the provision of a cottage, potatoes, milk, and board and lodging was generally to make these the only benefits provided. In certain instances, farmers continued extra old-time benefits such as fuel, rabbits, manure, vegetables, or straw, and efficient workers were sometimes rewarded by the use of a cow or by an allowance of butter, but it is thought that these additional allowances were quite exceptional.

With the exception of agriculture it has long been illegal under the Truck Acts in almost all industries to make deductions from a worker's wages in respect of goods provided, or to make payment otherwise than in cash, but the Truck Committee of 1908 in their Report make no recommendation for the extension of the Act to include workers in husbandry. From evidence given to the Foreign Office relating to 1907 it appears that in foreign countries and in the colonies agriculture is similarly excluded from any existing legislation as to truck. These facts, viewed in conjunction with the policy of the Agricultural Wages Board (which decided, despite general agreement on the principle of payment in cash as far as possible, to recognise certain benefits in part payment), indicate that the disadvantages and abuses of the system of payment in kind which obtained in the case of workers in commercial and industrial enterprises, cannot apply to workers in agriculture. On the other hand, if the system is continued on the lines introduced by the Wages Board and now adopted by many Conciliation Committees by which allowances reckoned in part payment of wages are confined to benefits the values of which are easily assessable, it will no doubt continue to suit the convenience of both farmers and workers

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Scholarships for Children of Agricultural Workers.

THE Ministry of Agriculture announces the award of the following scholarships for the sons and daughters of agricultural workmen and others, in connection with the Scheme established under Section 3 of the Corn Production Acts (Repeal) Act, 1921 :—

Class I Scholarships, for three years, tenable at University Departments of Agriculture—

Mr. F. H. E. Beard, 24, Creswick Walk, London, N.W.11.
Miss Hilda Broadbent, 7, Moorlands Place, Halifax.
Mr. David S. Davies, Rhydywenol, Login, Carmarthenshire.
Mr. Evan E. Edwards, Esgair Farm, Borth, Tregaron, Cardigan.
Mr. George H. Lyon, Moor Farm, Sleaford, Lincs.
Miss Annie Newton, 1, Forest Rise, Whipps Cross, E.17.
Mr. Hugh G. Owen, Tyddyn Burn, Pentraeth, Anglesey.
Mr. Richard Roberts, Maesgraian, Trawsfynydd, N. Wales.
Mr. Frank R. Sanders, 23, Malmesbury Road, Chippenham.
Mr. Reginald W. Smith, 2, Ivy Terrace, Maney Row Green, Holyport, Berks.

Class II Scholarships, for two years, tenable at Agricultural Colleges—

Mr. William C. Collett, Church Lane, Weston-on-the-Green, Bicester, Oxon.
Miss Margaret L. Edwards, Fwrlode, Llanbedr, Crickhowell, Breckonshire.
Miss Isabel M. Hudson, 15, Glebe Terrace, Shirbeck, Boston, Lincs.
Miss Dorothy Kenyon, Mount Oswald, Penmaenrhos, Old Colwyn.
Mr. Maurice B. Lilley, Wereham, Stoke Ferry, Norfolk.
Miss Ethel E. Price, Penyscheol, Llanishen, Chepstow, Mon.
Mr. Llewelyn Roberts, Wern Pontlyfni, Llanwnda, Carnarvonshire.
Mr. Donald Rowe, Garen, Lelant, Cornwall.
Mr. Sidney S. J. Travers, Hill Top, Kingsdown, Deal.

Class III Scholarships, for courses not exceeding one year, tenable at farm schools and similar institutions—

Eighty-nine scholarships have been granted, fifty-six to boys and thirty-three to girls for short courses in agriculture, horticulture, dairying, poultry-keeping, &c.

The occupations followed by the parents or guardians are :— Agricultural workmen, 21; working bailiffs, 6; small holders, 25; market gardeners, 3; working gardeners, 6; other rural occupations (*e.g.*, harness maker, roadman, estate carpenter, village shopkeeper, etc.), 14. The remaining 33 scholarship holders were bona fide wage-earners in the agricultural industry, and of these the fathers of 23 are dead.

adopted for basic slag. If, however, the manurial application is delayed till the spring the high soluble slag or superphosphate alone should be used.

The Manuring of Arable Crops.—In regard to arable crops potatoes and mangolds must, as already stated, be liberally treated; there should be a complete manure, and, in the case of mangolds, a dressing of salt as well. For potatoes a general recipe would be:—2 cwt. sulphate of ammonia, 3 cwt. superphosphate, and 1½ cwt. sulphate of potash, with farmyard manure.

For mangolds the following may be used:—1½ cwt. nitrate of soda or nitrate of lime, 2½ cwt. superphosphate, 3 cwt. French or German kainit, and 2 cwt. salt, with farmyard manure in addition.

These recipes, of course, require modification to suit local conditions. In regard to potatoes, muriate of potash usually gives the same yield as sulphate, but in some cases there is a falling off in quality. Kainit, however, should not be used other than in exceptional cases where it is known to be satisfactory.

Swedes in the south of England may be grown either with dung or with artificials, whichever is the more convenient, though in the drier districts it may be difficult to secure a good plant unless dung is used. If artificials are used they should contain a liberal proportion of phosphates and 1 cwt. or 1½ cwt. of sulphate of ammonia, nitrate of soda or nitrate of lime.

Corn very often receives nothing in the way of manure, but this is not really a sound procedure. Barley in which seeds are to be sown should receive phosphates—superphosphate in the south country or basic slag in the western and northern parts of England. In some districts it is found that finely-ground mineral phosphates which have gone through the 120-mesh sieve are equally effective and cheaper; this is particularly the case in Northumberland. The advantage of the phosphate is seen in the additional yield or quality of barley and in the better take of the clovers.

Spring Dressings for Crops.—Finally, provision should be made for giving the corn crop spring dressings of nitrogenous manures. It is, however, impossible to foretell what dressings would be needed for this purpose, as this is largely influenced by the winter rainfall. A mild wet winter is a time of serious losses of nitrate on arable land, and these have to be made good before the winter corn can start into vigorous growth.

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending August 8th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.10	13.15	13.10	12.17	16. 7
„ „ Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 2*	13. 2*	13. 2*	13. 2*	(N)12. 7
„ „ „ neutral (A. 25¾ per cent.)	14. 5*	14. 5*	14. 5*	14. 5*	(N)13. 5
Kainit (Pot. 12½ per cent.)	...	..	...	1.17	3. 0
„ (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 5	3. 3
Sylvinite (Pot. 20 per cent.)	...	...	...	2.12	2. 7
Potash Salts (Pot. 30 per cent.)	...	...	...	3.10	2. 4
„ „ (Pot. 20 per cent.)	..	...	...	2.10	2. 6
Muriate of Potash (Pot. 50 per cent.)	9.10	7.10	8. 0	7. 0	2.10
Sulphate of Potash (Pot. 48 per cent.)	...	..	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
„ „ (T.P. 30 per cent.)	...	...	...	3. 0§	2. 0
„ „ (T.P. 26 per cent.)	2.13§	2.10§	...	...	...
„ „ (T.P. 24 per cent.)	2. 9§	2. 6§	2. 2§	...	...
„ „ (T.P. 20-22 per cent.)	...	2. 3§	.	2. 7§	2. 4
„ „ (T.P. 18 per cent.)	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.)	4. 7	...	3.15§	3. 7	1.11
„ (S.P. 30 per cent.)	3.17	3. 5	3. 7§	3. 0	2. 0
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	8.15	8.10	...
Steamed Bone Flour (T.P. 60 per cent.)	8 10†	7. 2†	6.15	6.10	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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MONTHLY NOTES ON FEEDING STUFFS.

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Mineral Needs of Farm Stock.—In previous issues of this *Journal* attention has been drawn to the value of adding mineral mixtures to rations deficient in this respect, and stress has been laid on the necessity for a guarantee when purchasing such mineral substances that they are fit for feeding purposes. Products of this

DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	Cwt. s.	Ton. £ s.	£ s.	£ s.		s.	d.
Wheat, British	—	—	12/6	12 10	0 15	11 15	71·6	3/3	1·74
Barley, British Feeding	—	—	9/3	9 5	0 12	8 13	71	2/5	1·29
" Danubian "	29/6	400	8/3	8 5†	0 12	7 13	71	2/2	1·16
Oats, English Black and Grey	—	—	9/8	9 13*	0 13	9 0	59·5	3/–	1·61
" Scotch White	—	—	12/8	12 13	0 13	12 0	59·5	4/–	2·14
" Canadian No. 2 Western	29/6	320	10/4	10 7	0 13	9 14	59·5	3/3	1·74
" No. 3 "	28/6	"	10/–	10 0	0 13	9 7	59·5	3/2	1·70
" Feed	27/3	"	9/6	9 10	0 13	8 17	59·5	3/–	1·61
" American	25/9	"	9/–	9 0†	0 13	8 7	59·5	2/10	1·52
" Argentine	28/3	"	9/11	9 18	0 13	9 5	59·5	3/1	1·65
Maize, American	40/–	480	9/4	9 7	0 13	8 14	81	2/2	1·16
" Argentine	41/–	"	9/7	9 12	0 13	8 19	81	2/3	1·20
Beans, Rangoon	—	—	7/6	7 10†	1 11	5 19	67	1/9	0·94
Millers' offals :—									
Bran, British	—	—	—	6 0	1 6	4 14	45	2/1	1·12
" Broad	—	—	—	7 0	1 6	5 14	45	2/6	1·34
Middlings, Fine, Imported	—	—	—	9 17	1 2	8 15	72	2/5	1·29
Middlings, Coarse, British	—	—	—	9 7	1 2	8 5	64	2/7	1·38
Pollards, Imported	—	—	—	7 0	1 6	5 14	60	1/11	1·0
Meal :—									
Barley Meal	—	—	—	9 12	0 12	9 0	71	2/3	1·34
Maize "	—	—	—	11 0	0 13	10 7	81	2/6	1·34
" Germ Meal	—	—	—	8 10	0 18	7 12	85·3	1/9	0·94
" Gluten-feed	—	—	—	8 15	1 6	7 9	75·6	2/–	1·07
Locust Bean Meal	—	—	—	8 0	0 9	7 11	71·4	2/1	1·12
Bean Meal	—	—	—	12 7	1 11	10 16	67	3/4	1·78
Fish "	—	—	—	16 5	4 6	11 19	53	4/6	2·41
Linseed	—	—	—	19 0	1 10	17 10	119	2/11	1·56
" Cake, English 9°/₀	—	—	—	10 15	1 17	8 18	74	2/5	1·29
Cottonseed Cake, English 5½°/₀	—	—	—	7 2	1 14	5 8	42	2/7	1·38
" " Egyptian 5½°/₀	—	—	—	7 0	1 14	5 6	42	2/6	1·34
Decorticated Cottonseed Meal 7°/₀	—	—	—	12 0†	2 13	9 7	71	2/8	1·43
Coconut Cake 6°/₀	—	—	—	8 10	1 10	7 0	73	1/11	1·03
Ground Nut Cake 7°/₀	—	—	—	8 10	1 15	6 15	56·8	2/5	1·29
Palm Kernel Cake 6°/₀	—	—	—	5 17†	1 3	4 14	75	1/3	0·67
" " Meal 2°/₀	—	—	—	4 17	1 4	3 13	71·3	1/–	0·54
Feeding Treacle	—	—	—	5 10	0 8	5 2	51	2/–	1·07
Brewers' Grains :—									
Dried Ale	—	—	—	6 7	1 4	5 3	49	2/1	1·12
" Porter	—	—	—	5 17	1 4	4 13	49	1/11	1·03
Wet Ale	—	—	—	0 17	0 9	0 8	15	0/6	0·27
" Porter	—	—	—	0 15	0 9	0 6	15	0/5	0·23
Malt Culms	—	—	—	8 0†	1 13	6 7	43	3/–	1·61

* New. † At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices :—N, 12s. 7d. ; P_2O_5, 4s. 4d. ; K_2O, 2s. 4d.

nature are now available with this guarantee, and a Mr. F. E. Corrie has prepared a leaflet on " The Mineral Needs of Farm Stock," copies of which can be obtained free on application to Star Cottage, Lingfield, Surrey.

Fish Meal for Feeding.—A correspondent has written that the notes on this subject, which appeared in the August issue of this *Journal*, apparently condemned the use of fish meal for live stock. This is obviously not so, as mention is expressly made of the fact that fish meal, of the right kind, fed under proper conditions, is a perfectly sound and wholesome feeding stuff, but that taint will occur if fish meal rich in oil is fed, or if fish meal is fed in excessive quantity.

Use of Home-Grown Cereals for Feeding.—In this *Journal*, December, 1922. pp. 780 and 783 two articles were published on the use of home-grown wheat, oats and barley for live stock, and a leaflet was also issued. Farmers have now had time to put the advice contained therein to the practical test, and in view of the probability that a considerable proportion of home-grown cereals will be fed again this year, the writer would be glad if readers will communicate with him giving their experiences. and particularly mentioning any departures from the rules laid down in those articles, which they found necessary. Such letters addressed to the Secretary, Ministry of Agriculture, 10, Whitehall Place, S.W.1, do not require a stamp.

FARM VALUES.

CROPS.	Value per Ton on Farm.		Manurial Value per Ton.		Food Value per Ton		Starch Equivalent per 100 lb.	Value per unit S.E.		Market Value per lb. S.E.
	£	s.	£	s.	£	s.		s.	d.	d.
Wheat - - - - - -	8	10	0	15	7	15	71·6	2	2	1·16
Oats - - - - - -	7	2	0	13	6	9	59·5	2	2	1·16
Barley - - - - - -	8	6	0	12	7	14	71·0	2	2	1·16
Potatoes - - - - -	2	2	0	3	1	19	18·0	2	2	1·16
Swedes - - - - -	0	17	0	2	0	15	7·0	2	2	1·16
Mangolds - - - - -	0	15	0	2	0	13	6·0	2	2	1·16
Good Meadow Hay - -	3	18	0	13	3	5	31·0	2	1	1·12
Good Oat Straw - - -	2	1	0	6	1	15	17·0	2	1	1·12
Good Clover Hay - -	4	7	1	0	3	7	32·0	2	1	1·12
Vetch and Oat Silage - -	1	17	0	7	1	10	14·0	2	2	1·16

Use of the Tables.—The two tables given in this article, and which also appear every month, are intended as a guide to the economical purchase of feeding stuffs. In the large table a comparison is made of the cost per unit of feeding value of the different feeding stuffs offered for sale on the market, and the intending purchaser's attention is drawn to the most economical foods on offer. In the " Farm Values " table, the value per ton for feeding is given for the majority of the home-grown foods on a strictly comparative basis with the cost of similar foods on offer in the open market. These "Farm Values" are of use when the farmer wishes to ascertain whether to sell his home-grown foods and purchase other foods, or whether to use his home-grown foods.

* * * * * *

Crop Competitions in 1920 and 1921 in the Province of Namur.

M. PIERRE ALSTEEN gave an account at the International Congress of Agriculture, held in Paris in May last, of the farm competitions held by the Agricultural League of the Province of Namur in 1920 and 1921. The province was divided into six districts according to the quality of the soil, and the competitions in each dealt principally with the crop most typical in it, these comprising wheat, spelt, oats and potatoes. The societies in the district were informed during the preceding winter of the holding of the competitions, and at the beginning of June a first classification of the crops of their members was made by a Committee which was as far as possible unconnected with the district.

In accordance with the results of this first examination three classes of diplomas were awarded to the most successful members of each society. A competition between the different societies was then decided by a further examination of the crops belonging to their members which were placed highest in the first inspection. This was made by a Committee of State Agriculturists and a representative of the League, and money prizes were awarded to the successful societies. Such prizes, which vary from 200 to 750 francs, may not be distributed to their members but used for the purchase of implements for common use, improved seed, demonstration plots, etc. The societies are judged according to the following scale of points:—Number of members, 10; choice and treatment of seed, 20; manuring and freedom from disease, 20; cultivation and cleanness of land, 20; appearance of crop and probable yield, 10; skill and knowledge of the cultivators, 10; general results, 10.

In the course of the two years' competitions more than 1,200 fields have been carefully examined by the judges and 91 societies participated.

Great improvements in the methods of cultivation followed have already been noticed. In each district the best farmers are brought into prominence; the best crops are distributed in the district for seed; the use of fertilisers is increasing and cultivation is more carefully carried out.

Fruit Growing and the Federation of British Growers.

A FORWARD step of much interest and importance to the fruit growing industry, was taken by the Federation of British Growers, when it decided to hold its annual meeting in a fruit growing district and pay visits to fruit plantations in the neighbourhood. By such visits growers are brought into direct contact with the methods and views, successes and failures of their fellow growers under conditions which may differ widely from their own, but from which, nevertheless, the most valuable lessons may be learned. More than a hundred growers from the important fruit growing counties met at Cambridge on 29th May for the first of these visits, and the interest displayed and the keen discussion aroused ensure the annual repetition of such a useful event.

The first visit was to the small apple plantation of Mr. J. G. Faircliffe, Burwell, which embodies the results of twenty years' experience in the combination of fruit and poultry. There is little depth of soil over the chalk, and the fruit consists chiefly of Lane's Prince Albert and Worcester Pearmain on paradise, planted 8 ft. apart each way, and closely spur pruned on a long spur system. The plantation is in its thirteenth year and is divided up into pens of 10 or 12 rods each, most of which contain 10 laying hens while the remainder are reserved for chicken rearing. The poultry keep down the grass and no cultivation, spraying or manuring is done. The party was much struck both by the method of pruning and the absence of damage by pests. That the latter was not mere chance was shown by the presence of a moderate supply of the usual varieties of pests.

The party then proceeded to Burwell Fen where the plantations of Mr. R. Stephenson are managed by Mr. Faircliffe. These extend to 85 acres, the land varying from heavy clay at one end to peat at the other. The area was formerly down to asparagus, but is now under apples with some plums. The chief varieties are Emneth Early, Lane's Prince Albert, Worcester Pearmain, Grenadier, Lord Derby, Bramley Seedling and Newton Wonder. The first three are closely spur pruned on Mr. Faircliffe's system, the severity of which may be gauged by the fact that the varieties are almost indistinguishable in shape from each other in winter. The next two varieties are spurred every other year, and the last two are allowed to go except for thinning. The land became foul during the war and all but 5 acres is now being grazed by pigs, which were started four years ago. No cultivation or manuring is done but the trees are regularly sprayed. In spite of some damage from insect attack and severe frosts, there appeared to be a promise of a fair crop of the earlier varieties. At neither of these places was the foliage up to its usual high standard, but it has to be remembered that the fen winter in May is a serious enemy. The cold store in course of construction near a private railway line was also inspected.

The next visit was to 50 acres of fruit grown on heavy land by Messrs. Robert Ingle, at Kingston. The area was planted 15 years ago with apples, plums, bush fruit and strawberries. The chief interest was centred in the black currents, which had leaves of French type, though the growth of the bush and the fruit was typical of Baldwin. The stock came from France some years ago.

At Croxton Park the party was entertained to tea by Lady Newton in the absence of Sir Douglas Newton, K.B.E., President of the Federation. The fruit farm of nearly 100 acres of heavy clay land has been planted during the last 14 years with apples, pears, plums, bush fruit and strawberries. The visitors were much impressed by the clean condition of the land and still more by the clean condition of the trees, due to early and adequate spraying.

After dinner at Cambridge, Mr. W. G. Lobjoit (Controller of Horticulture) said the Federation was fortunate in having at its disposal the services of Sir Douglas Newton as President and Mr. Seabrook as Vice-President. It was now able to speak with quite respectable weight of numbers in the councils of the nation. He referred to the Federation scheme of grading and packing which the Ministry was assisting through its officers and those of the County Councils. An American grader had been purchased and would be at the disposal of growers. He congratulated them on what had been done and felt there never was a time when co-operation and combination were so essential to deal with commercial questions.

Mr. Seabrook in reply said that Sir Douglas Newton was absent on their business in the House of Commons. The Federation had marked time during the reorganisation, but was now making rapid progress and could be said really to represent the industry. Mr. Stephenson on behalf of the West Cambs. Fruit Growers' Association welcomed the members of the Federation and regretted that their visit should have taken place in such a bad year.

Early the next morning the party saw a film made on the farms of Messrs. Seabrook & Sons, depicting all the operations of a fruit farm, from the propagation and planting of the tree, to the grading and packing of the fruit and its departure by motor lorry.

The party, conveyed in three char-a-bancs and eleven motor cars, then proceeded to visit some of the smallholders of Cambridgeshire. The plantation of Mr. F. L. Handley, Cottenham, of two acres of strawberries and young trees on heavy wet clay, was greatly admired for its fine tilth and the healthy appearance of the strawberries, which were almost as good as one could wish to see. This was especially remarkable as the land was practically derelict for 4 years while the holder was on active service. Mr. C. T. Chivers, Cottenham, was then visited. This plantation consists of top fruit with gooseberries under, on the famous greensand soil of the district. This was a good sample of the best methods in the district and the freedom from pests, cleanness of the land and promise of a crop were greatly admired.

Another good plantation seen was that of Mr. J. R. Smith, Willingham. Great interest was taken in the young trees of Bramley Seedling, Newton Wonder and James Grieve, pruned under the direction of Mr. A. T. Paskett (Cambs. County Horticultural Adviser).

The next visit was to a young 20-acre plantation, belonging to Mr. J. P. Pentelow, J.P., at Somersham (Hunts). This consisted of young apples, pears and plums pruned under the advice of Mr. F. Tunnington (Hunts County Horticultural Adviser). The under crops were gooseberries, currants, raspberries and strawberries, all doing very well—especially the gooseberries and strawberries.

The party then made for Wisbech where they were welcomed by Mr. W. C. Selby on behalf of the Wisbech Fruit Growers' Association at lunch. Mr. H. V. Taylor (Deputy Controller of Horticulture) expressed the thanks of the whole party to those growers who had so kindly thrown their plantations open to inspection, and Messrs. J. P. Pentelow, J.P., E. Sandall and E. C. Gardiner replied.

A brief inspection was made of the 30-acre plantation of Messrs. Gardiner Bros. Contrary to the usual Wisbech practice, dessert as well as cooking varieties of apples are grown and the trees are closely spur pruned. Remarkably regular crops are obtained under this system, even on Bramley Seedling.

After tea at Wisbech, the return to Cambridge was made under arctic conditions, so that growers from the west and south thought the Fenlanders must be a hardy race. After dinner Mr. T. W. Attwood, President of the New Zealand Fruit Growers' Federation, gave an informal address. He urged the vital necessity for organisation as the foundation of successful marketing, and growers were especially interested in the method of collecting funds to support the organisation, which is undertaken by Government.

The majority of the party accepted the invitation of Mr. W. P. Seabrook to visit the extensive plantations and nurseries of his firm at Boreham, Essex. On arrival the growers saw an American "Cutler" grader at work, driven by electricity. This is the first machine introduced into this country which grades by weight—the only method which gives perfect satisfaction when the apples are to be packed in boxes. A small hand dusting machine from which the dust is driven out by a revolving fan also aroused great interest. The home plantations consist chiefly of apples, Cox's Orange Pippin and Worcester Pearmain, the latter especially promising a heavy crop. After being entertained to lunch, the party made a tour of the nursery stock. Toppinghoe Hall was then visited where all varieties of hardy fruit are grown, and especial interest was displayed in the black currants and cordon apples.

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The Colorado Beetle in France.

THE *Revue de Zoologie Agricole* for August, 1922, contains a full account of the outbreak of the Colorado Beetle in France and the measures that are being taken for its suppression. In view of the danger of its introduction into this country the following summary should be of value to potato growers.

On 9th June, 1922, M. Mondon, President of the Agricultural Union of Taillon, saw on the leaves of his potatoes numerous red larvæ of an entirely new appearance, subsequently identified as those of the Colorado Beetle. Inquiring further he found that several adjacent fields were similarly affected and that in some the crops were already lost. It was then proved that this pest already existed over an area of more than 100 square miles to the north-west of Bordeaux. The centre of infestation appeared to be near the village of Sénéjac where the larvæ had been seen in July, 1921, and it was supposed that the insect was accidentally introduced at this point in 1919 or 1920 with merchandise imported from America. The development of the affected patch was more accentuated towards the south, and this appeared to be accounted for by the predominance of northerly winds in May and June at the period when the beetles' longest flights usually take place. At the time of discovery the wind had already spread the insect far across the pine region, where the warm and sandy soil seemed specially favourable to it and there were many wild *Solanaceæ* (plants of the potato family) capable of serving as food for it. It had also spread towards the north, and to the west until stopped by the sea. Road and rail transport may have also done their share in assisting the spread. To the east very little extension was observed.

Many outbreaks were stamped out in a short time by measures varying according to the case, from simple collecting of the insects to the destruction of the crops. Other infested areas, where the only measure undertaken was arsenical spraying, are still not free. Preventive measures were carried out with care in several Communes where equipment for the purpose was set up by the local authorities, but wherever defence measures were left to the initiative of the cultivators they lacked uniformity and were altogether insufficient. By July, 1922, however, a special fund of 500,000 francs was voted by the French Chamber for combating the pest, and regulations were made by the French Ministry of Agriculture (*a*) prohibiting the importation of potatoes from the U.S.A. and Canada and prescribing the inspection of other vegetables, and (*b*) prohibiting the transport of potatoes and tomatoes, the boxes, etc., used for carrying them, and also manures, etc., from infected to uninfected districts.

Control Measures.—The article goes on to state that the measures that can be taken against the beetle differ according to the firmness with which it has become established. Where, as in the United States, eradication is now hopeless the means available for keeping it in check are (1) the encouragement of natural enemies, (2) insecticides (arsenates or Paris green) applied as a spray or in powder, and (3) cultural practices—winter ploughing to expose the hidden insects, etc.

Previously in Europe the situation has been different. The beetle has hitherto been discovered on a small area soon after its arrival and the object has been to prevent it spreading and to exterminate it as quickly as possible. The affected plot has been isolated; all the perfect insects, their eggs and larvæ, or possibly the whole crop, collected, and drenched with paraffin or benzol; and the soil turned and liberally moistened with the same products.

The outbreak in France, however, presents a new problem. The present infestation when discovered had already spread over an area of more than 100 square miles, and it was therefore too late to take drastic action. A full account is given in the article of the measures now being taken in France. The importation of potatoes from the United States and Canada is prohibited and other vegetables and fruit from the same source are inspected. An infected zone and a protective zone have been delimitated, and the transport of potatoes, tomatoes, egg-plants, packages, etc., prohibited. In the protective zone cultivators are required to spray, and in the infected zone to apply any other measures prescribed. Over the whole extent of the territory the declaration of all plots planted with potatoes is obligatory.

It is pointed out that whether there is merely a danger in an uninfected country of the importation of the pest, or whether there is already a considerable infestation, the first essential defence is propaganda, in order to make known to cultivators the appearance of the beetle and its harmfulness, and to bring home to them the necessity of declaring its presence when found and either taking, or submitting to, the necessary remedies. Its existence must be discovered as quickly as possible wherever it occurs, so as to keep the centres of infection as small as possible and enable it to be stamped out. The pest is stated to have been allowed to spread by the ignorance or indifference of cultivators, or even through their evading declaration of its presence, through mistrust of the measures that may be taken to destroy it. The distribution of leaflets with coloured illustrations is advocated, and the exhibition of specimens in a frame on the walls of meeting rooms and local offices. Teachers can also contribute by directing the attention of their pupils to the pictures and inducing them to bring specimens of all insects found in potato fields.

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THE following statement deals with the acreage under crops and numbers of live stock in England and Wales on 4th June, 1923:—

Agricultural Returns, England and Wales, 1923.

The preliminary tabulation of the Agricultural Returns collected on the 4th June, 1923, in respect of agricultural holdings above one acre in England and Wales shows that the total area under crops and grass is 25,941,000 acres, comprising 11,182,000 acres of arable land and 14,759,000 acres of permanent grass. The total area of crops and grass shows a reduction of 85,000 acres on last year's figures, but the area returned as rough grazings is 78,000 acres more than in 1922, so that the net reduction in the area of land coming within the scope of these Returns is thus 7,000 acres. All classes of live stock except horses show an increase.

As compared with 1922, the arable area has fallen by 129,000 acres, while permanent grass shows an increase of 44,000 acres. The reduction in the arable area is mainly accounted for by the corn, pulse and potato crops.

Cereals.—The total area under the three chief cereals, including mixed corn, is 5,162,000 acres, or 458,000 acres less than in 1922. All three cereals have declined, wheat by 226,000 acres, barley by 35,000 acres, and oats by 190,000 acres. The area of wheat is the lowest since 1913, but is about the average of the ten years 1905-1914. The barley area is larger than in 1915, but with the exception of that year, is the lowest on record. The area under oats is practically the same as in 1913 and rather larger than in 1914.

Beans and Peas.—The area of beans at 234,000 acres and of peas at 141,000 acres, show substantial reductions of 50,000 acres and 32,000 acres respectively on last year's figures. The area of beans is the smallest during the last twenty years, excepting that of 1917, while apart from the war period the area of peas is the lowest on record.

Potatoes.—The total area of potatoes 467,000 acres, is 94,000 acres less than in 1922. There has been a reduction in all parts of the country, consequent on the poor financial results of last year's prolific crop, but this year's area is still larger than in any year before the war.

Roots.—The area returned as under turnips and swedes is 861,000 acres, this being 40,000 acres more than in 1922. The area of mangolds, however, at 403,000 acres shows a decline of 20,000 acres, but with the exception of 1922 is the largest since 1915.

Fruit.—The area of orchards is returned at 232,000 acres or 12,000 acres more than in 1920. Small fruit, however, shows a decline, this year's area of 63,700 acres being 11,000 acres less than in 1922, though it is larger than in the two years 1919 and 1920. Small fruit is grown largely in orchards, and although growers are asked to show figures for small fruit separately in the Return, it is possible that this may not have been done very exactly in all cases.

Other Crops.—The area of other crops has, on the whole, declined, this being mainly due to a large reduction of nearly 50,000 acres in the case of vetches or tares. Mustard and lucerne both show relatively large increases, and there is a notable increase in the area of sugar beet, which is twice that of last year. Hops show a decline of 1,600 acres.

Clover and Rotation Grasses.—The area of clover and rotation grasses was greatly reduced last year owing to the failure of the 1921 sowings. That loss has now been recovered, and this year's area of 2,601,000 acres is the largest since 1911. The area of these crops which is reserved for hay is 287,000 acres greater than in 1922, which more than makes up the small decline of 58,000 acres in the area of permanent grass for mowing.

Horses.—The number of horses on agricultural holdings has again fallen, the total of 1,281,000 this year being 59,000 less than in 1922. The decline in breeding continues, the number under one year old being only 66,000, or 18,000 less than last year.

Cattle.—The total number of cattle at 5,822,000 is 100,000 more than in 1922, and is now back to the pre-war level. Cows and heifers in milk or in calf number 2,614,000, or 92,000 more than in 1922, and this year's total is the highest on record. The number of calves is 29,000 less than last year, this, no doubt, being partly due to the heavy fall which was recorded last year in the number of heifers in calf. That fall, however, has practically been recovered this year.

Sheep.—The total number of sheep is 13,832,000, or 394,000 more than in 1922, when a fall of practically the same number was recorded. The number of breeding ewes has again improved, this year by 69,000, and the satisfactory prices both for mutton and wool which have been ruling this season may lead to a further increase in flocks.

Pigs.—Pig breeding and feeding has been fairly remunerative since last year, and the number of pigs shows the large increase

PRELIMINARY STATEMENT of Acreage under CROPS and GRASS and Numbers of LIVE STOCK in England and Wales on 4th June, 1923.

DISTRIBUTION.	1923.	1922.	INCREASE.		DECREASE.	
	Acres.	*Acres.*	*Acres.*	*Per Cent.*	*Acres.*	*Per Cent.*
TOTAL ACREAGE under all CROPS and GRASS	25,941.000	26,026,000	—	—	85,000	*0·3*
*ROUGH GRAZINGS	4 859.000	4,781,000	78,000	*1·6*	—	—
ARABLE LAND	11.182.000	11,311,000	—	—	129,000	*1·1*
PERMANENT GRASS For Hay ..	4.355 000	4,418,000	—	—	58,000	*1·3*
PERMANENT GRASS Not for Hay ..	10 404 000	10,302,000	102,000	*1·0*	—	
PERMANENT GRASS TOTAL ..	14.759 000	14,715,000	44,000	*0·3*	—	—
Wheat	1.741 000	1,967,000	—	—	226,000	*11·5*
Barley	1.329.000	1,364,000	—	—	35,000	*2·6*
Oats	1.974 000	2,164,000	—	—	190,000	*8·8*
Mixed Corn	118.200	125,200	—	—	7,000	*5·6*
Rye	73.700	84,600	—	—	10,900	*12·9*
Beans	†234.300	285,000	—	—	50,700	*17 8*
Peas	†141.400	173,600	—	—	32,200	*18·5*
Potatoes	466.700	561,200	—	—	94 500	*16·8*
Turnips and Swedes	861 400	821.100	40,300	*4·9*	—	—
Mangold	402.900	422,600	—	—	19,700	*4·7*
Cabbage, Savoys and Kale	72.200	73,300	—	—	1,100	*1·5*
Kohl-rabi	12.900	16,200	—	—	3,300	*20·4*
Rape	77.900	75,200	2.700	*3·6*	—	—
Vetches or Tares	86.700	136,200	—	—	49,500	*36·3*
Lucerne	57.900	50,600	7,300	*14·4*	—	—
Mustard	52.900	39,600	13 300	*33·6*	—	—
Brussels Sprouts	16.900	15,000	1,900	*12·7*	—	—
Cauliflower or Broccoli	11.200	10,500	700	*6·7*	—	—
Carrots	10.100	14,100	—	—	4,000	*28·4*
Onions	2.400	3,600	—	—	1,200	*33·3*
Sugar Beet	17.000	8,400	8,600	*102·4*	—	—
Linseed	8.900	4,800	4,100	*85·4*	—	-
Hops	24 900	26,500	—	—	1,600	*6·0*
Small Fruit	63 700	74,700	—	—	11,000	*14·7*
Orchards	231.900	‡220,000	11.900	*5·4*	—	—
CLOVER and ROTATION GRASSES For Hay ..	1,815 000	1,528,000	287,000	*18·8*	—	—
CLOVER and ROTATION GRASSES Not for Hay	786.000	775,000	11,000	*1·4*	—	—
CLOVER and ROTATION GRASSES TOTAL ..	2,601.000	2,303,000	298,000	*12·9*	—	—
BARE FALLOW	435.300	405,000	30,300	*7·5*	—	--

LIVE STOCK.

	No.	*No.*	*No.*	*Per Cent.*	*No.*	*Per Cent.*
Horses used for Agricultural purposes (including Mares for Breeding)	798,000	805,100	—	—	7,100	*0·9*
Unbroken Horses (including Stallions) One year and above	207.400	230,600	—	—	23,200	*10·1*
Unbroken Horses (including Stallions) Under one year ..	66.200	83,900	—	—	17,700	*21·1*
Other Horses	209,600	220,900	—	—	11,300	*5·1*
TOTAL OF HORSES	1.281.200	1,340,500	—	—	59,300	*4·4*
Cows and Heifers in Milk	1.974.500	1,934,000	40,500	*2·1*	—	—
Cows in Calf, but not in Milk	269.000	288,600	—	—	19,600	*6·8*
Heifers in Calf	371.000	299,300	71,700	*24·0*	—	—
Other Cattle :—Two years and above ..	1 018.200	922,900	95,300	*10·3*	—	—
,, ,, One year and under two	1.108 000	1,167,100	—	—	59,100	*5·1*
,, ,, Under one year	1.081.400	1,110,800	—	—	29,400	*2·6*
TOTAL OF CATTLE	5.822.100	5,722,700	99.400	*1·7*	—	—
Ewes kept for Breeding	5.497.200	5,428,100	69,100	*1·3*	—	—
Other Sheep :—One year and above ..	2.541.300	2,289,900	251,400	*11·0*	—	—
,, ,, Under one year	5,793.300	5,720,000	73,300	*1·3*	—	—
TOTAL OF SHEEP	13.831.800	13,438,000	393,800	*2·9*	—	—
Sows kept for Breeding	388.400	302,000	86,400	*28·6*	—	—
Other Pigs..	2.223.000	1,996,900	226,100	*11·3*	—	—
TOTAL OF PIGS	2.611.400	2,298,900	312,500	*13·6*	—	—

---

* Mountain, Heath, Moor, Down and other rough land used for grazing.

† In addition there were 4,900 acres of beans and peas grown for fodder in 1923.

‡ As returned on 4th June, 1920.

of 312,000. This year's total of 2,611,000 is the highest since 1911. The number of sows kept for breeding is 388,000 or more than 25 per cent. above last year's figure, and is the largest recorded since 1895.

ACREAGE OF HOPS.

PRELIMINARY STATEMENT compiled from the Returns collected on the 4th June, 1923, showing the ACREAGE under HOPS in each COUNTY of ENGLAND in which Hops were grown, with a COMPARATIVE STATEMENT for the Years 1922 and 1921.

COUNTIES, &c.		1923.	1922.	1921.
		Acres.	Acres.	Acres.
KENT	East	3,540	4,100	4,010
	Mid	5,200	5,530	5,410
	Weald	6,710	7,110	6,630
	Total, Kent ...	15,450	16,740	16,050
HANTS		1,020	1.070	1,040
HEREFORD		3,890	3,950	3,520
SURREY		210	220	200
SUSSEX		2,270	2.350	2.270
WORCESTER		1,950	2,030	1,960
OTHER COUNTIES		100	90	90
	Total	24,890	26,450	25,130

* * * * * *

Yellow Rattle.

THE Agricultural Organiser for Buckinghamshire (Mr. John Porter, B.Sc.) reports that Yellow Rattle (*Rhinanthus Crista-galli*, L.) was abundant in the meadows this year, and at one centre the horse-sprayer was used. In addition, plots were laid off to test finely-ground kainit, sulphate of ammonia, etc., applied in the dry state when the leaves were wet.

Where the full-strength sulphate of ammonia spray* was used the results were highly satisfactory, the Yellow Rattle being killed out. Fortunately, the red clover was very little damaged. With regard to the kainit, etc., applied in the dry state, these were only partially effective. This may be due partly to the leaves of Yellow Rattle not being sufficiently wet to hold the dry powder and partly to imperfect distribution by hand. On those plots where the leaves were sufficiently wet and the distribution was uniform both sulphate of ammonia and finely-ground kainit proved effective in reducing the weed. Yellow Rattle is dealt with in the Ministry's Leaflet No. 251.

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* 2 cwt. to 50 gal. water per acre.

Wart Disease of Potatoes Order, 1923.

All growers of potatoes who wish to sell any part of their produce for seed are reminded that potatoes sold for planting in England and Wales must be officially certified either—(*a*) as having been grown on land free from Wart Disease, or (*b*) as having been inspected and found to be free from the disease, or (*c*) as being of an approved immune variety true to type.

As regards potatoes grown in England and Wales the certificates will be issued by the Ministry. The necessary inspections may be made by an Inspector of the Ministry or by some competent person previously approved by the Ministry.

When potatoes are sold for planting, the seller must furnish the buyer with the number of the certificate relating to the potatoes sold. In order to assist both buyers and sellers of potatoes, it has been arranged that the certificate numbers shall have prefixes as follows:—

C.L. (=clean land) for potatoes grown in clean districts or from crops which have been inspected and on which no Wart disease has been found; and

T.S. (=true stocks) for approved immune varieties which have been inspected and found to be true to type.

The letter A will be used in addition for potatoes grown in an infected area, and the certificates for such potatoes will thus have numbers prefixed by A.C.L. or A.T.S.

Certificates will not be required by a grower who wishes to plant seed saved from the crop grown in the previous year on the same premises.

Growers who intend to sell seed potatoes must make early application to the Ministry for the necessary certificates. Growers of immune varieties should apply for inspection of their crops whilst growing, in order that they may obtain the certificate necessary to enable the potatoes to be planted in infected land. If the crop is not inspected only a "C.L." or "A.C.L." certificate can be issued, and the seed will not be allowed to be planted in infected land. It will be necessary in districts in and near infected areas for crops of susceptible varieties also to be inspected before a "C.L." or "A.C.L." certificate can be issued.

The Ministry will be prepared to arrange for the necessary inspections, the fee for which will be 2s. 6d. per acre or part of an acre. No charge will be made for the issue of certificates where no inspection by the Ministry's officers is entailed.

* * * * * *

Poultry-keeping: Volume of Leaflets.

THERE have been great developments in the poultry industry since the war, and it is being more and more realised that, in view of the enormous imports of eggs and poultry from abroad, there is ample room for its further expansion. In keeping poultry for profit, it should be realised that prices are tending to fall, and it is essential that sound practical and business methods should be adopted if profitable results are to be expected.

To assist poultry-keepers and others with the best general advice that is procurable the Ministry of Agriculture has issued its collected leaflets and has included with poultry those on other small live stock, pigeons, rabbits and goats. The information given in these leaflets is based on sound knowledge and experience, but is in most cases only intended to serve as an introduction to the various subjects dealt with. Poultry-keepers in country districts should remember that in most counties in England and Wales there is a County Poultry Instructor who has been appointed to assist poultry-keepers in the county to overcome their practical difficulties. Should the services of the instructor be desired, a communication should be sent to the County Agricultural Organiser. who may usually be addressed at the County Offices. Amateurs in cities and suburban districts are recommended to join the local poultry society, if there is one.

The volume is to be obtained on application to the Ministry's Office at 10, Whitehall Place. S.W.1, price 1s., post free.

* * * * * *

Midland Agricultural College Poultry Conference.

A ONE-DAY poultry conference will be held at the Midland Agricultural and Dairy College, Sutton Bonington, Loughborough, on Tuesday, 25th September, 1923. Short papers will be read on "Some Aspects of Poultry Nutrition," by Capt. E. T. Halnan; "Chicken Rearing," by George A. Palmer; "Breeding for Egg Production," by Tom Newman; Naked Eye Characteristics of Diseases—a demonstration by Capt. J. P. Rice. Lunch and tea will be provided at the College. Farmers, poultry keepers, and others interested in poultry keeping are cordially invited to attend. Further particulars can be had on application to the Principal of the College.

* * * * * *

New Canadian Plant Import Regulations.

THE Ministry of Agriculture and Fisheries desires to give notice that new regulations have been issued by the Canadian Government governing the entry of nursery stock and plants into the Dominion. The regulations, so far as concerns produce from England and Wales, come into force on the 1st of September, and may be summarised as follows:—

The term "plant" or "plants" includes all members of the vegetable kingdom and any plant or product of a plant. The term "nursery stock" includes all plants for ornamental purposes or propagation. Seeds and seed potatoes are not included.

All shipments of nursery stock imported into Canada from this country must be accompanied by a certificate of inspection and a permit must be obtained by the importer. An official certificate must accompany the invoice and a copy of this certificate must be attached to each container. These certificates must be issued and signed by an authorised official, and must state that the nursery stock covered by the certificate has been duly examined by him and has been found apparently free from any pest or disease. Each container must also be clearly marked with the names and addresses of the consignor and consignee and the port of entry; in addition, a declaration showing the quantity, kind and value of the nursery stock contained therein, must be affixed. Nursery stock will only be admitted through the following ports: Niagara Falls, Ont., St. John, N.B., Montreal, Que., and Vancouver, B.C. Nursery stock will also be liable to inspection at the port of entry, and if found to be infected with any pest or disease, to protective treatment or destruction. The importation of nursery stock into Canada through the mails is prohibited. The importation of potatoes is prohibited, as also is the importation of the following species of the genus Pinus and horticultural varieties, namely:—White Pine (*Pinus Strobus L.*); Western White Pine (*Pinus monticola Dougl.*); Sugar Pine (*Pinus Lambertiana Dougl.*); Stone or Cembrian Pine (*Pinus Cembra L.*); and all other five-leaved species of the genus Pinus: all species and varieties of currants and gooseberries (Ribes and Grossularia) but not including the fruits of the latter, European Buckthorn (*Rhamnus cathartica L.*) and Common or Rust Barberry (*Berberis vulgaris L.*) and their hybrids and horticultural varieties: also all species and varieties of *Berberis* and *Odostemon* (Mahonia) susceptible to Crown Rust of Oats and Black-stem Rust of Wheat respectively, including *B. Amurensis Rupr.*; *B. aristata D.C.*; *B. Canadensis*

Pursh.: *B. ilicifolia Forst.*; *B. Lycium Royle*; *B. Nepalensis Spreng.*; *B. Sibirica Pall.*; *O. Aquifolium Rydb.* and all species and varieties of the *genera Pseudotsuga, Tsuga and Larix.*

The Ministry is prepared to arrange for the necessary examination and certification of consignments on payment of a fee at the rate of 2 guineas per day for each inspector. The minimum fee charged will be 1 guinea. Special arrangements will be made for the inspection of small consignments at the Ministry's office.

* * * * * *

REPLIES TO CORRESPONDENTS.

Feeding Wet Brewers' Grains to Milch Cows.—D.U. asks whether the feeding of wet brewers' grains to milch cows increases or diminishes the milk or cream.

Reply: The use of wet brewers' grains increases the yield of milk, but if fed excessively tends to diminish the percentage of cream contained therein. Information as to the feeding of wet grains is given on p. 3 of Leaflet No. 388.

Willow Beetle.—F.W. & S. sent a specimen of Golden Willow attacked by beetles (no other variety damaged) and asked for means of control.

Reply: The willow you enclose is badly attacked by the common Willow Beetle, dealt with in Leaflet No. 301.

In regard to measures of control, a thorough spraying with a wash containing nicotine appears to give the best results. A formula for preparing such a spray is given in the Leaflet. It is essential to spray the plants very thoroughly and if beds are rapidly re-infested from neighbouring plantations it may be necessary to spray a second time in order to kill the beetle grubs.

This particular kind of beetle appears to attack almost exclusivly rods of the *viminalis* section, seldom if ever damaging such *triandra* varieties as Black Maul or Champion Rod.

Pests in Grass and Meadow Land.—T.L.J. asks for information as to pests killing grass in meadow-land, for identification and control measures.

Reply: The insects involved are Aphides, or Green Fly, of a different species, but similar to those attacking roses, fruits trees and other plants.

From the specimens enclosed, however it is apparent that the Aphides have been subject themselves to attack by parasites—in fact the parasitised specimens are in the great majority. These can be readily detected as they are the dried, globular bodies attached to the grass and from which the black Hymenopterous flies which have parasitised them are now emerging. These parasitised specimens are quite different in appearance from the green, living Aphides, which have not been so attacked.

The parasites being so much in evidence, it is extremely likely that the greatest amount of damage has now been done and the attack, as such, will have practically died out. Any control measures, therefore, would probably do more harm than good as the beneficial parasites would fall victims in greater numbers than the Aphides, any of which now remaining are likely to become the prey of the first generation of parasites now emerging.

It is highly improbable that the presence of these insects upon the grass would have any deleterious effect upon grazing cattle.

Lettuce Disease.—G.C.M. asked early in May for information on a disease occuring in patches among lettuces, and the methods of control.

Reply: The lettuce is attacked by the fungus *Marssonia panattoniana*, which is sometimes very destructive, especially in houses. It is much assisted out of doors by, damp muggy conditions—in fact, the same conditions that favour *Botrytis*.

Sulphur is indicated as a preventive, and all cultural conditions that tend towards less moisture and more ventilation are recommended. Growers in America have found using a system of sub-irrigation instead of overhead watering of assistance, but of course this only applies in certain cases. (An article on this disease appeared in this *Journal*, May, 1923, p. 147.)

Bladder Plum Disease.—Mrs. M. wishes to know the cause of and the remedy for the Bladder Plum disease, two of her young damson trees being badly attacked, and another slightly.

Reply: The Ministry has not published a leaflet on this disease, which does not cause serious damage, though it is said to be common in certain parts of the west of England. In Worcestershire Plum Pockets occur chiefly on the varieties Victoria and Czar, but less frequently on the Yellow Pershore. The Mycelium of the fungus (*Exoascus pruni*) is perennial in the wood, and plum pockets occur each year, though with varying abundance. They are said to be more prevalent when fine warm weather follows the flowering period.

As to control, the only method that can be recommended is to cut out the affected parts. The shoot should be cut out a foot or eighteen inches below the diseased plum, to try and get rid of the perennial mycelium above referred to.

Currant Clearwing Moth.—C.W.V. sent in April specimen Red Currant Twigs containing larvæ and asked for the pest to be identified, and what treatment should be applied.

Reply: The currant twigs are suffering from the attacks of the Currant Clearwing Moth. The eggs of this insect are laid in the shoots and the caterpillars on hatching bore into the stem, feeding within the pith, and eventually killing the shoot. Treating with caustic winter wash would be of no value as the caterpillars live beyond the reach of any insecticide. The only method of dealing with the pest is to prune away all weakly and dying branches or shoots, the prunings being burnt. In cutting back branches, care should always be taken to cut to healthy wood, that is to say, to cut beyond the ending of the tunnel made by the pest.

American Sweet Clover.—D.W. asks for information about this plant.

Reply: There is a biennial variety of *Melilotus alba* known in this country as Bokhara Clover. A Canadian strain is referred to in this *Journal*, September, 1921, p. 554. There is also an annual variety, which, under the name of Hubam Clover has lately been attracting considerable attention in America. See this *Journal*, March, 1923, p. 1152. It is recommended that trials of either, if made, should be on a small scale at first.

* * * * * *

Foot-and-Mouth Disease.—*Yorkshire, East Riding.*—No further outbreak occurred in this district subsequent to that at Skeffling on 29th June last, and the general restrictions on the movement of animals in the locality were withdrawn on 27th July.

Bedfordshire.—Following the outbreak on 3rd July at Stevington near Bedford, 16 further cases of the disease have been confirmed in the County of Bedford, the last of which was on 3rd August. All of these were within the area originally scheduled by the Ministry. In consequence it has not been practicable to proceed very rapidly with the modification of the restrictions imposed on the movement of animals in the district surrounding the original outbreak, but the area affected by these restrictions has been reduced to one of approximately 10 miles radius round Renhold, in which parish the majority of the later outbreaks in this county were located.

Hampshire and Surrey.—On 25th July a fresh case of the disease was discovered at East Worldham, near Alton, Hampshire, on premises from which animals had on the previous day been sent to Guildford Market for sale. These animals were traced to their destinations (a slaughterhouse in Guildford and a railway truck at Walton-on-Thames) and were found to be also affected with disease. Restrictions on the movement of animals were consequently applied firstly to an area of 15 miles radius round East Worldham, and secondly to an area of 20 miles radius round Guildford, in order to cover the possible distribution of disease from Guildford Market.

As regards Hampshire there have been 8 further outbreaks of the disease within a few miles of the original case at East Worldham, the latest of which occurred on 10th August.

In Surrey there have been no cases of the disease discovered except in the animals which were sent from East Worldham to Guildford Market and are referred to above.

Certain portions of the area surrounding Guildford, which included parts of the Counties of Sussex, Berkshire and Buckinghamshire were released from restrictions on 8th August, and the restrictions have since been removed except in respect of small areas surrounding Alton and Guildford.

Leaflets issued by the Ministry.—Since the date of the list given on page 377 of the July issue of the *Journal*, the following leaflets have been revised.

No. 21.—The Warble Fly.
„ 295.—Marketing of Eggs.
„ 366.—The Manufacture of Whey Butter.

The following Leaflets have been re-written.

No. 114.—The Scientific Principles of Feeding Poultry.
„ 317.—The Rearing of Chickens.

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W. 1.

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(Established 1905.)

THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE
Vol. XXX. No. 7.

OCTOBER, 1923.

NOTES FOR THE MONTH.

The Agricultural Rates Act, 1923.

The Agricultural Rates Act, 1923, received the Royal Assent on 2nd August last, and gives effect to the undertaking given on behalf of the Government early in the year that further relief should be given to farmers in respect of local rates. It provides that occupiers of agricultural land, as defined in the Agricultural Rates Act, 1896, shall pay in respect of that land one-quarter of the rate in the pound payable in respect of buildings and other hereditaments. The amount by which it is estimated that farmers' rates will be reduced as a result of this concession is £2,750,000 for England and Wales and £480,000 for Scotland. The deficiency thus arising will be made good to the spending authorities by an additional grant from the Imperial Exchequer. The fixed grant already payable under the Agricultural Rates Act, 1896, is left undisturbed, but the new grant is to vary from year to year in accordance with the rise or fall of the rates.

The Act is to be deemed to have come into operation on the 1st April, 1923. Where before 1st September, 1923, a farmer has paid rates in excess of the amount that he is now liable to pay, the excess amount will be deducted from the next instalment of rates, or in certain instances will be recoverable in cash.

The Act is to continue in force until the 31st March, 1925, unless Parliament otherwise determines. Copies can be obtained from His Majesty's Stationery Office, Kingsway, London, W.C.2, price 3d. net, exclusive of postage.

* * * * * *

Milk Prices.

At the meeting, held on 11th September, of the Joint Committee of Producers and Distributors of Milk, agreement was reached as to the prices to be paid to producers for milk delivered into London during the twelve months October, 1923, to September, 1924,

(50929) P.6./R.4. 8,750. 10/23. M. & S. A

and as to the prices at which milk would be retailed in London during that period. These prices are as follows:—

Months.	*Producers' Price per imperial gallon.*	*Retail Price per quart.*
October, November and March	1/5 ...	7d.
December, January and February ...	1/8 ...	8d.
April to September	1/- ...	6d.

These prices compare with 1s. 8d. per gallon during the six winter months 1922-23 and 1s. per gallon during the six summer months of 1923, retail prices being 8d. per quart during the winter and 6d. during the summer.

Certain changes have been made in the scheme in force last year as regards the quantities of milk to be paid for as liquid and manufacturing milk respectively. For the new season these will be governed by the average quantities delivered during the basic period—the three months December to February. During the six winter months—October to March—the liquid milk price as above will be paid for 95 per cent. of the average quantities delivered during the basic period, the balance being paid for as manufacturing milk. In April, July, August and September, the liquid milk price will apply to 15 per cent. more than the quantity delivered during the basic period, and in May and June to 10 per cent more. The price to be paid for manufacturing milk will be settled each month and will be 2d. per gallon less than the price per lb. of Canadian and New Zealand cheese.

* * * * * *

Foot-and-Mouth Disease.

FARMERS have again had cause for apprehension owing to the number of outbreaks of foot-and-mouth disease which have appeared in various parts of England during the past month. The two groups of cases in Bedfordshire and Hampshire which commenced in July were stamped out by the middle of August. Unfortunately, fresh cases occurred on 27th August at Rotherham, and on 28th August at Blackpool. Subsequent outbreaks appeared in Cheshire, having been caused by the unloading at Crewe on 1st September, of animals from Fleetwood which had been indirectly infected by persons who had been amongst the affected animals at Blackpool. Animals from Crewe carried the disease into Buckinghamshire on 7th September, and into Salop (Baschurch) on 11th September. At the same time fresh centres of disease were established without any known origin near Southampton on 4th September, and at Torquay on 5th September, at Old Clee, Grimsby and Whitchurch, Somerset, on 23rd September.

The total number of outbreaks which have been confirmed on and subsequently to 27th August are as follows:—

Yorks. (W.R.) ...	1	Devonshire ...	4
Lancashire ...	12	Salop ...	4
Cheshire ...	22	Somerset ...	1
Southampton ...	5	Lindsey ...	1
Buckinghamshire ...	5		

Searching inquiries have been made by the Ministry into the movements of animals connected with all these outbreaks, and whilst it is still possible that further cases may arise on premises in the close vicinity of existing outbreaks, it is considered that the spread of the disease due to the infection of the loading docks at Crewe in the beginning of September has been checked, and that no further danger need be apprehended of a wider spread of disease arising therefrom. Every effort is being made locally to confine the disease centres within the narrowest possible limits.

* * * * * *

Agricultural Conciliation Committees.

IT is hoped that the Conciliation Committees will shortly be holding meetings for the consideration of rates of wages for the coming winter, and in this connection the Minister has addressed the following communication to the members of the employers' sides of the Committees:—

> "I hope that many Conciliation Committees will be holding meetings shortly for the consideration of rates of wages to be paid during the coming winter. Conditions vary in different parts of the country, but no doubt arguments will be brought forward by the labourers' representatives in support of an increase in wages while the representatives of the employers may on their side give reasons against such a decision.
>
> "One point which in the opinion of the Government should be borne in mind by the employers in these discussions is that in the succeeding six months they will receive some substantial relief under the Agricultural Rates Act.
>
> "As you are no doubt aware, this Act, which takes effect as from the 1st April, 1923, provides that an occupier of agricultural land in England shall be liable to pay only one-quarter (instead of one-half as hitherto) of the rate in the pound payable in respect of other forms of rateable property. Farmers will thus directly and immediately benefit as regards their

assessment to local rates, and to this extent will be in a more favourable position than would otherwise be the case.

"In the course of the proceedings in the House of Commons on the Bill, I stated that the labourer stood to gain by it and that I was convinced that its passage would have the effect of causing wages to rise. Should that not turn out to be the case it will make it much more difficult to pass any further measures designed for the benefit of agriculture as a whole.

"In these circumstances, I hope that you as the representatives of employers will take this fact into consideration in any discussions on your Committee as to rates of wages."

* * * * * *

The Agricultural Index Number.

THE general index number of the prices of agricultural produce increased from 53 per cent. above 1911-13 in July to 54 per cent. above in August. On the whole, August prices were on the same level as those of April and May, there having been a rise of 3 points from the minimum of June, due in the main to the much higher level of prices for potatoes of this year's crop. As compared with a year ago the general index number is lower by about 8 per cent.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	54
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

The prices realised for such of the new crops of wheat and oats as reached the markets during August were considerably lower than those paid for old crop, so that the average prices show an appreciable decline on the month, wheat falling by 11d. and oats by 1s. 9d. per cwt. Wheat averaged 29 per cent. above pre-war and oats 30 per cent. above, as compared with

58 and 59 per cent. above, respectively, in August, 1922, but last year the new crops were rather later in coming on the market. Barley remained steadier, and with some of the new crop of malting quality on the market the average price rose appreciably in the last week of the month. Potatoes show a further rise and early potatoes sold during August in the wholesale markets at 80 per cent. above pre-war as compared with only 14 per cent. above a year ago. Clover hay became appreciably cheaper during August, but meadow hay showed little change, and generally hay realised prices about 34 per cent. above pre-war.

The prices realised for fat cattle were 4d. per stone less than in July, but this reduction was relatively smaller than is usual at this time of the year, and the index figure consequently shows a rise of one point. Fat sheep prices were a shade higher on the month and averaged 76 per cent. above August 1911-13, a rise of 4 points on the month, sheep remaining relatively much dearer than other fat stock. Prices of fat pigs have risen steadily since the middle of July, but the average increase over July was relatively less than usual and the index figure dropped from 54 to 52 per cent. above pre-war.

The demand for the better classes of dairy cows improved during August and prices advanced, and at the end of the month first quality animals in milk were making about £1 10s. per head more than at the beginning of July. Store cattle are usually cheaper in August than in July, and the average decline of about 5s. per head as compared with last month leaves the index figure unchanged at 28 per cent. above August, 1911-13. Store sheep still remain very dear, and realised during August slightly more than double the pre-war price, whilst store pigs, though cheaper than in July, were also more than 100 per cent. above pre-war.

The average contract price of milk remained unchanged in the London and Birmingham areas, but advanced by 3d. per gallon in the Manchester district, so that over all contract prices advanced to 67 per cent. above August, 1911-13. Butter and cheese became appreciably dearer, butter averaging 2¾d. per lb. more than in July, and cheese advancing by 11s. per cwt. Butter was therefore 48 per cent. and cheese 67 per cent. dearer than in August, 1911-13. Eggs also advanced more sharply than was usual in August before the war, the index figure showing a rise of 32 points to 68 per cent. above pre-war. Owing to labour troubles at the docks in Ireland, hardly any Irish butter or eggs were on the English market during August, and part of the increases in the prices of English butter and eggs may be attributed to the consequent shortage of supplies.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	August	Apr.	May	June	July	August
Wheat	53	31	37	38	39	29
Barley	48	11	16	17	12	9
Oats	59	39	42	41	41	30
Fat cattle	70	51	53	52	45	46
Fat sheep	103	100	103	83	72	76
Fat pigs	92	71	72	69	54	52
Dairy cows	67	55	50	50	49	51
Store cattle	42	29	33	31	28	28
Store sheep	114	92	98	114	109	101
Store pigs	128	131	126	130	113	102
Eggs	64	37	43	40	36	68
Poultry	85	75	77	87	79	61
Milk	70	70	63	53	57	67
Butter	77	68	40	33	37	48
Cheese	51	92	42	44	54	67
Potatoes	14	—28*	—28*	—31*	66	80
Hay	54	40	41	42	38	34

Decrease.

* * * * * *

The Potato Position.

THE Minister addressed the following letter to the Secretary of the National Farmers' Union of Scotland on 3rd September, in answer to correspondence on the question of the Agricultural Tribunal's recommendation that imports of foreign potatoes be permitted only under general licence:—

"In reply to your letters of the 11th and 28th August with regard to the import of foreign potatoes into this country, I would remind you that this question was very fully discussed at a deputation which I received on the 17th July last of English and Scottish farmers and potato growers, including Mr. Alexander Batchelor, the Vice-President of your Union, and, as I then explained, it would be impossible to secure the necessary Parliamentary sanction this year to your proposal for the restriction of imports of foreign potatoes. I then stated that the Cabinet had given the matter careful consideration and had decided not to propose legislation at the present time to empower the Government to prohibit the import of potatoes from overseas.

"With regard to the low prices realised for potatoes in 1922, while imports of Dutch potatoes may have caused the fall in prices last summer to have been more rapid than might otherwise have been the case, there can be no doubt that the main cause of the slump was the abnormal yield of home-grown potatoes. A total production of about 4,000,000 tons from the agricultural holdings of Great Britain is sufficient for the country's needs, whereas the total production last year was about 5,200,000 tons. The total imports from foreign countries into Great Britain and Ireland in 1922 were 171,500 tons, or only 3½ per cent. of the total production of Great Britain alone, and of these 98,000 tons were early potatoes from France and the Channel Isles which are not generally considered to be competitors with the home-grown crop. Only 35,800 tons came from Holland and practically none came from that country after August, so that it cannot be seriously contended that imports from Holland kept prices at the very low level at which they remained throughout the season.

"Turning to this year it is true that the total imports up to date show an increase over 1922, but this has been entirely due to the large increase in imports of quite early potatoes from France and the Channel Isles: the imports from Holland have so far proved below the figures for the corresponding period last year. Whereas 7,274 tons arrived from France in the week ending 4th August, the import in the week ending 25th August had declined to 452 tons, from which it may be presumed that the French supply is now practically exhausted and was of the early variety.

"In addition the area under potatoes for human consumption in Holland is officially reported to be 20 per cent. less than last year, while the yield per hectare is expected to be lower.

"The Dutch exchange also is against this country, and this in itself would have a deterrent effect in purchasing potatoes from Holland. In fact the imports from Holland up to date ought not to have had any appreciable effect on the price of the British new crop, unless, as has been suggested, growers have been frightened into taking lower prices by reports of large supplies of Dutch potatoes being available or likely to become available at a low price. It is significant that last week it was reported at Hull market, an important market for Dutch potatoes, that the supply was practically finished and that this week no quotations were given.

"In your letter of the 11th and the accompanying resolution it was suggested that growers were expecting serious losses again this year, but the trend of prices up to date does not appear to confirm that contention. In the wholesale markets of England and Wales prices last week for first quality potatoes averaged £7 11s. per ton for Duke of York and £7 16s. for Sharpe's Express, while King Edwards were £9 per ton, whereas in the corresponding week of last year average prices for the same varieties were £3 16s., £4 and £4 16s. 6d. per ton respectively.

"Similarly in Scotland wholesale prices realised in the week ending 22nd August for first quality potatoes were from 70 to 100 per cent. higher than for the corresponding week last year, *e.g.*, first earlies at Edinburgh and Glasgow were £7 and £6 13s. per ton respectively and £4 and £3 5s. per ton in 1922. The free on rail prices to producers both in England and Scotland show an even larger increase over last year's figures, *e.g.*, at Wisbech, King Edwards were making £7 to £7 10s. per ton f.o.r. for the week ending 29th August against £2 10s. to £3 a year ago, and these prices are rather higher than the prices for the previous week, while last year at the same time prices were still declining. In Edinburgh first earlies were quoted at £5 5s. to £6 per ton on rail compared with £2 to £2 7s. 6d. per ton on rail at the same time in 1922. Again Dutch potatoes which were only on offer in two markets, Bristol and London, last week were realising £7 to £7 10s. per ton, which is very little below the rate for the best British early varieties.

"A further important factor in the potato situation is that the area under potatoes in Western Europe is generally lower than the area last year, while a lower yield is also anticipated. In England and Wales the acreage under potatoes has declined by over 94,000 acres (17 per cent.), and although the figures for Scotland are not yet available it is thought that they will also show a decline.

"It has been suggested that, owing to the depreciated currency German potatoes are reaching this country via Holland, consigned as Dutch, and that this might cause a serious depression of the British price. I have made enquiries on this point and find that the export of potatoes from Germany is entirely prohibited, so that there can be no question of any danger from such a source.

"In general I think that there is good reason to suppose that the fears of a serious loss again occurring in the potato growing industry this year are much exaggerated."

AGRICULTURAL LANDOWNERS.

II.

THE RT. HON. LORD ERNLE, M.V.O.

Landowners and the Supply of Cottages.—Another charge against agricultural landowners is that they provide an inadequate supply of cottages, and destroy independence by attaching their occupation to work on particular farms.

Admittedly there is a lack of cottage accommodation even in purely agricultural areas. But the deficiency is greatest in urban districts where wages are highest; it is smallest in agricultural districts where wages are lowest. In urban areas the building of small houses as a commercial speculation by private enterprise has, for various reasons. been checked. But on agricultural land cottages are very rarely built as a commercial speculation either for sale for profit, or as a remunerative investment. They are built by agricultural landowners because they recognise a duty to house the labour employed on their land. They build them also in their own interest. Without accommodation for the workers farms could not be let. The better the provision of good cottages, the better the class of farmer and of worker that the farm will attract. Apart from questions of water-supply or of distance from school, the sites of cottages are chosen so that men in charge of animals may be on the spot, and that other workers may be as near their work as possible. There are no trams or omnibuses in agricultural districts. This is the reason why the occupation of cottages is attached to employment on particular farms. And the system cuts both ways. A man who removes to work on another farm is reasonably sure to find a vacant cottage near the scene of his labour.

Nor are agricultural workers the only occupants of houses tied to the discharge of a particular duty. Prime Ministers, Chancellors of the Exchequer, First Lords of the Admiralty, all live in tied houses. In rural villages the position is still more common; it is more the rule than the exception. Every tenant farmer, most land agents, all woodmen, keepers, gardeners, rural postmen, policemen, and road-men, lose their local homes, if they lose their local job.

Still the system is not ideal In towns, men may lose their employment in a particular factory, but they retain their homes. In agricultural districts, workers lose both together: they depend, in most cases, on their employers both for wages and house. I wish that I could see any practical substitute for the existing system. On the estates on which I worked for many years, the cottages were not let to farmers who sublet to the men they employed; they were let direct to the workers by the landowner. The system gave no greater security of tenure to the worker. When a farmer dismissed a man, the Estate Office always gave the necessary notice to quit. But it had advantages. Workers, I think, liked to feel that one man paid their wages and another let them their cottage. Apart from this sentiment, cottagers found it easier to get repairs done or a smoky chimney corrected, and it made, though slightly, for permanence because no farmer likes to be known to his landlord as unable to keep his men. The system of direct letting by the landowner is more frequently adopted than is generally realised.

I am going to offer for consideration a Return made to the Land Agents' Society in 1914 relating to 22,727 cottages. They are not selected; they are on different properties; and they cover practically all the counties in England and Wales. But in fairness I must warn you that they may not be a perfectly fair sample. They are on large estates, and, however objectionable large estates may be, they are probably better equipped with cottages than most smaller properties.

There are then 22,727 cottages, built by agricultural landowners out of their own money to house the agricultural labour employed on their estates. Of them only 13,200 are occupied by the agricultural workers for whom they were intended. Of these, 5,508, or 41·73 per cent., are let direct by landowners to the occupants. Who occupy the remaining 9,527 cottages? With one class of occupiers everyone sympathises: 3,137 of the houses are occupied by pensioners and widows. Old age pensions have been an immense boon to rural districts. But their value has been greatly enhanced by the kindly feeling which has allowed old people to remain in their homes, either rent free, or at the cheap rates allowed to workers on the estates.

There remain 6,390 cottages built by agricultural landowners, as part of their duty and interest, to house the agricultural labour employed on their estates. They are in the occupation of persons employed by the Government, or by Local Authorities, or by industrial capitalists other than agricultural landowners. All these occupants are brought there in the interest and for the convenience of their employers. If these employers did their duty as satisfactorily as agricultural landowners, and housed the labour they employ, there would be little or no deficiency of cottages in agricultural districts.

One other point in this connexion may be made. County Councils are now the largest agricultural landowners. On the new holdings created since the war, houses have been generally provided for the small holders. But at the end of December, 1918, County Councils had provided 12,487 holdings. In the case of 2,159, houses had been sold or leased to the Councils. For the remaining 10,328 the Councils had built 609 houses, thus leaving 9,719 of their tenants, so far as they are concerned, homeless, depending on the provision made by others.

It is sometimes said that only a sixth, or 16 per cent., of the cottages in rural districts have gardens of more than an eighth of an acre. That statement is not confirmed by the Return. It shows that out of the 22,727 cottages, 6,350 have gardens of less than an eighth of an acre, and 16.377 have an eighth or more. That is to say slightly over 72 per cent. have gardens of 20 poles and upwards. The fact that so many of the men have gardens at their doors is one reason why the demand for allotments is relatively small in agricultural districts.

Even if it were conceded that some agricultural landowners are not bloated parasites, and that something may be said for the administration of some of their estates, the admission would not meet two other popular charges. One is that they have usurped the rights of the People and, to put it bluntly, are possessors of stolen goods: the other is that the private ownership of land is contrary to the laws of nature and natural rights. These are large subjects. It is only possible to suggest a few points for your consideration.

Possession of Stolen Goods.—The origin of private property in land is lost in the mists of antiquity. Possibly it originated very largely in the right of the first comer. When wandering hordes began to settle and cultivate the soil, individuals staked out their holdings, cleared them, and grew their crops. Public opinion recognised their claim to ownership. The right of the first comer is still acknowledged every day. An omnibus is a public conveyance. Everyone has a right, on payment, to a seat. But, as the omnibus fills up, the first comers sit, the later arrivals are strap-hangers. Whether this is or is not the main source of private property in land, most people would probably agree that it has stimulated the progress of civilisation. But, to-day, many think that, whatever its past services, it hinders the evolution of a more perfect State. That is not my subject. Our question is whether there is any historical evidence that the People ever owned the land of the country. Ask any of the great historians of the University, and they would tell you, and, I believe, unanimously, that no evidence exists of the ownership of land by the community, and that there is, on the contrary, clear evidence in Anglo-Saxon times of estates owned by private persons, and cultivated by tenants both free and unfree, who paid to the owners labour services, or cash or produce, for the use of the land which they occupied and cultivated in common. Under different names, and in varying stages of development, manorial institutions existed among the Anglo-Saxons, if not in the Celtic age, centuries before the Conqueror reduced them to the system which, at the point of the sword, he imposed on conquered England.

On the antiquarian side, the charge, it may therefore be suggested, fails. Private property in land cannot represent a series of encroachments on the rights of the community, unless those rights ever existed, and of their existence there is no evidence. But the charge has also a modern side. To-day the land of the country is occupied in compact blocks by individual farmers who cultivate it by the labour of wage-earning workers. This uniform method of occupation and cultivation has displaced the older system of village farms occupied and tilled by groups of villagers, which may be traced through Norman, Anglo-Saxon, Roman, and, possibly, Celtic times. Whether this displacement of collective farming by individual farming meant a change of ownership is the point under discussion. On the answer rests the charge of robbery. Without dispute, the village open-field farms were occupied in common, cultivated in common, grazed in common. But to substantiate the charge of robbery, it must be proved that they were owned in common by the occupying cultivators.

The change from collective to individual occupation had been in gradual progress since the 13th century. But up to 1750, from a third to half the cultivated land of England was still occupied by groups of village farmers. It was in the reign of George III (1760-1820) that the change proceeded at an almost revolutionary pace. England was fast becoming a hustling manufacturing country instead of an easy-going agricultural country. Population rose rapidly. It shifted from the South to the North, and gathered round the coal and iron fields or the textile factories in densely crowded industrial districts from which arose the cry for bread and meat. From 1793 to 1815 the demand for food was made more urgent by pressure of war and fear of famine. Under these changed conditions, drastic alterations were needed in village farms. They were self-sufficing, self-supporting units, raising food for the producers but little or no surplus for sale. To feed millions of artisans farms had to be changed from domestic industries for home consumption into factories of bread and meat, on which the new rotations of crops could be introduced, and live stock winter-fed and improved. The village farms were swept away. Economically, the policy succeeded. Between 1760 and 1821 population doubled: so, under improved farming, did production. In 1831-41 the land of the United Kingdom not only fed its additional population, but was feeding 8 million more people than it was feeding in 1914 or feeds to-day. The result is the more remarkable because agriculture had not yet recovered from the collapse which followed the peace of 1815, or profited by the discoveries of agricultural science.

The main features of the village farm were its arable land and its pasture. The former was generally divided into three great unfenced fields. Each year one field was sown in the autumn for wheat and rye; another was sown in the spring for barley, oats, peas and beans; the third field lay fallow. Each arable holding consisted of a bundle of acre or half-acre strips, equally distributed over the three fields, but designedly so scattered that no two strips were contiguous but were sometimes half a mile apart. The bundles of arable strips were held by different titles. Some of the holders were freeholders; others were copyholders holding of the Lord of the Manor on varying terms and conditions; others were leaseholders for lives, for life, or for terms of years; others were tenants from year to year, or at will. To these arable holdings were attached grazing and fuel rights over the pasture and waste, which were enjoyed by the same titles. Freeholders exercised them as part of their freehold; copyholders as part of their tenure; leaseholders and tenants as part of their tenancy. Grazing and fuel rights over the pastures and wastes were also attached to particular cottages. The owner of a privileged cottage exercised them as owner; the tenant of a privileged cottage enjoyed them in virtue of his tenancy and in consideration of the higher rent which he paid. Similar grazing and fuel rights might be acquired by squatters on the edges of the village farm, and legalised by lapse of time.

When Parliament sanctioned the enclosure of a village farm, commissioners surveyed and valued the land, and published an award in which they distributed it among those who proved ownership. Owners received a compact block of land corresponding in value to the scattered strips and grazing rights which they had owned in the village farm. There was no transfer of ownership—only a change in the subject matter owned. Those whose title was temporary and derivative—those, that is, who occupied under some form of tenancy—received no allotment in ownership. The same rule was followed with the cottages. Land in lieu of grazing rights was allotted to owners, not to tenants. Squatters of twenty years' standing were treated as freeholders: if their occupation was shorter their claim was dealt with as an encroachment and disallowed.

The awards of the Commissioners afford the best evidence on the charge of robbery. That small occupiers were opposed to enclosures, that the Parliamentary machinery was defective, that, over so large an area, mistakes were made or injustices done, must be admitted. But the awards show the number of ownership claims that were allowed. Many are in existence; a few have been printed. Twelve miles from Oxford is Steeple Aston where, in 1767, the village farm was enclosed. The award sets out both the new allotments and the quantities of arable land with grazing rights attached which the allottees had owned in the village farm. It deals with 968 acres. Tithe was extinguished by the allotment to the Rector of 156 acres. The remaining 812 acres were distributed in compact tithe-free holdings among 21 owners, according to the quantity and value of the land and common rights that they owned. The Lord of the Manor, Sir Charles Cottrell Dormer, received for his acreage and common rights 83 acres, a smaller area in quantity than he had owned in the farm. Three women are considerable freeholders. Lucy Buswell, in lieu of 4½ yardlands and common belonging, received 84 acres; Judith Lamley, 56 acres; Eliza Davis, 53 acres. One cottage owner received, in lieu of his rights of pasture, an acre and a half of freehold tithe-free land. It is a question whether these 21 owners would have sacrificed their legal rights for the benefit of neighbours who had none.

One other piece of evidence may be added. A Return of the Enclosure Commissioners in 1876 states that, between 1845 and 1876, 590,000 acres were enclosed. The area was distributed among 25,930 owners. 620 Lords of the Manors received 27,000 acres, an average of 44½ acres apiece. Owners other than Lords of the Manor received an average of 24 acres apiece. The remainder of the land was sold to pay expenses. If these two examples stood alone, and of course they do not, they would not confirm the modern charge that the present estates of agricultural landowners originated in wholesale robbery under enclosures. The study of the awards rather supports the conclusion that they were built up by the more prosaic and legal processes of purchase, marriage and inheritance.

Assuming that, neither historically nor legally, can agricultural landowners be convicted of wholesale robbery, there remains the statement that private property in land is contrary to the laws of nature and to natural rights. This is a statement which cuts away at the roots the peaceful evolution of society. It starts the world afresh, and in this destructive force lies its fascination for ardent spirits yesterday and to-day.

Laws of Nature and Natural Rights.—If there was a body of laws of nature established by the universal consent of mankind, it would determine many difficulties. By reference to it we could decide what are the moral rights of individuals, and what ought to be their legal rights. But there is no such universal consent, and therefore the laws of nature have settled no controversies and promoted many. Each century has given a different answer to the question what they are. To-day no two communities, no two individuals would return the same reply. Consequently, the natural rights that are supposed to be founded on these unknown laws are only the rights which, in the opinion of the person who claims them, ought to be recognised by public opinion and sanctioned by law. Evidence so vague and contradictory affords no firm foundation for legislative action. Reasoning and proof are still needed.

The plausibility of the statement mainly depends on a confusion between ordinary laws and laws of nature. An ordinary law commands something to be done or left undone. It enjoins or forbids, and thus creates corresponding duties, rights and wrongs. But a law of nature only states facts. "The earth goes round the sun" is a fact, or, if you like, a law of nature. But it enjoins and forbids nothing, and creates no rights, wrongs or duties. The most that can be said is that every living creature possesses powers, faculties and capacities which correspond with the facts or laws of its nature. There is no natural reason why those powers should not be used to the full without regard to any other living creature, and their unfettered exercise is, if you like to call it so, a natural right. But no one necessarily does wrong if he hinders the exercise of a natural right; it may even be his duty to resist it altogether.

Tigers are carnivorous animals. That is a fact or law of nature, and their powers correspond to the laws of their being. A man, therefore, is the God-given food of tigers. But he has no duty to be killed and eaten; he commits no wrong in resisting. Which kills which, depends on which is the strongest or the craftiest. "Man requires food and drink to sustain life." That is another fact or law of nature. If I, hard pressed by hunger, enter your house and eat your food, I am exercising a natural right, even though you starve. On the other hand, you have the natural right to knock me on the head, and eat your own food, though my starvation is the consequence. Neither tigers nor men do any natural wrong in exercising to the full their natural rights without any regard to others. Morality, mercy, justice, honour do not enter into the sphere of laws of nature. They belong to a different region of ideas. As regards tigers and men, or men and men, the exercise of natural rights means pandemonium, in which the weakest perish and the strongest survive.

Civilisation controls the exercise of natural rights, so that we may live together in progressive communities. For this purpose exist our code of morality, our ideals of honesty and justice, our civil and criminal law, marriage and other institutions. Take an illustration from the House of Commons. "Man communicates thought by articulate speech." That is a fact or law of human nature, and men have the vocal organs corresponding to this law of their being. It is their natural right to use those vocal organs freely, without regard to anyone else. Every member of Parliament, therefore, has the natural right to talk as loudly and continuously as he likes. That would be pandemonium, in which only the loudest voices would be heard. For mutual convenience the members submit to regulations; they forego their natural rights, and, except occasionally, only one member speaks at a time. In innumerable similar ways civilisation intervenes to control the exercise of natural right.

It would seem, therefore, that the peaceful progress of humanity is linked to the control of natural rights. We have recently experienced what the appeal to the laws of nature means. It was by those laws, and on the assertion of her natural rights, that Germany justified her war of aggression. In the public press, on platforms, in lecture rooms, in pamphlets and in less ephemeral literature, the argument was for many years developed. Germany needed more territory for her growth, and all men have equal natural rights to the use of all land. By conquest or fraud, so it was argued, Great Britain had appropriated a large part of the earth's surface. It is true that we had lavished our blood and our treasure upon our Empire; true that our possession had, in some cases, lasted for centuries: true that round it had gathered the reasonable expectations founded on a long period of quiet enjoyment; true that our exclusive occupation had been recognised in hundreds of international treaties and agreements. What do these things matter? One generation cannot rob another of the inalienable birthright of mankind. It is the natural right of nations as well as of individuals to seize and keep whatever they are strong enough to take. So a great nation turned its back on civilisation, abandoned its restraints, developed what a native writer called " the beast of prey conscience " and, by the brute force of numbers in the field, claimed the unfettered exercise of its natural rights.

The example might well make us hesitate to introduce into our domestic politics that appeal to laws of nature and natural rights which, in international politics, we defeated at the cost of rivers of blood and mountains of treasure. In a country without representative institutions, governed by an autocrat supported by a military aristocracy, the appeal is to numbers in the field and the arbitrament of battle. In a democratic country, with representative institutions, the appeal takes the shape of numbers at the poll, and the decision of the ballot. But in either case civilisation demands that honesty and justice, rather than mere force of numbers, should inspire Governments, and be the touchstone of action, whether international or domestic.

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THE GRADING, COMPOSITION AND FEEDING VALUES OF WHEAT OFFALS.

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As recently as in 1917, Wood and Adie* called attention to the circumstances which made it difficult to assign standard compositions and definite feeding values to the various grades of wheat offals. The confusion which had arisen was traceable to two main sources. In the first place, there existed a lack of uniformity in the naming of offals, and it frequently happened that the same name was applied in different localities to samples of offals which varied widely in size of particles and chemical composition. In the second place, there was a great variation in milling practice in different parts of the country, and whereas most of the larger mills separated their offals into four grades, many of the smaller mills were content with a much simpler division.

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* See this *Journal*, Vol. XXIII, No. 12, March, 1917.

In order to point the way out of the confusion which had arisen, Wood and Adie collected a number of representative samples of wheat offals from different districts and submitted them to investigation from a twofold point of view, namely, size of particles and chemical composition. As the samples were collected before the issue of the first Milling Order in 1917, the results of this examination may be taken as applying to normal pre-war wheat offals. As a result of sifting trials, it was concluded that where the offals were most completely separated, the division fell approximately into four grades :—

Grade 1.—*Fine middlings*, which did not pass through the silks ranging from Nos. 10 to 14 used for sifting out flour, but passed through silk sieve No. 3 (56 meshes per linear inch).

Grade 2.—*Coarse middlings*, which did not pass through silk sieve No. 3, but passed through wire sieve No. 24.

Grade 3.—*Pollards*, which did not pass through wire sieve No. 24, but passed through wire sieve No. 16.

Grade 4.—*Bran*, which did not pass through wire sieve No. 16.

In many mills, however, the offals were not so completely separated, and samples from these mills consisted of mixtures of two and sometimes even three of these grades. The results showed that, exclusive of the extreme bran grade, wheat offals could be classified into three "pure" grades (as above) and three "mixed" grades on the basis of size of particles.

That this system of classification possessed definite significance was shown by the chemical analysis of samples of the various grades. The average values obtained are shown in the following table, the results being calculated to the dry matter basis:—

TABLE I.

	Protein per cent.	*Fat.* per cent.	*Carbohydrates.* per cent.	*Fibre.* per cent.	*Ash.* per cent.
Bran	15·57	4·53	61·40	12·25	6·25
Pollards ...	16·60	5·49	64·03	8·88	5·00
Coarse middlings	18·98	5·81	64·96	6·11	4·14
Fine middlings	18·05	3·94	73·11	2·13	2·77

It will be noted that the different grades are sharply differentiated on the basis of their chemical composition. The fine middlings are richest in carbohydrates, the amount of the latter decreasing continuously as the size of the particles increases. On the other hand, the percentages of ash and fibre increase continuously as the particles increase in size. The fat and protein are highest in the case of the coarse middlings and decrease either as the particles become finer or coarser than in this grade.

It followed from the results of this investigation that the adoption by the milling industry of a simple and uniform system of grading wheat offals would make it possible to assign to each grade a standard chemical composition. In other words, a uniform system of grading according to size of particles would automatically ensure that the chemical composition of middlings, fine middlings, etc., was uniform throughout the country. Moreover, by means of feeding trials, it would further be possible to assign to each grade not only a standard composition, but also a definite feeding value. Such a procedure would be of advantage both to the miller and to the buyer of offals. As Wood and Adie pointed out, it would not actually be necessary to interfere with local nomenclature, provided the offals were sold with a simple designation indicating size of particle.

Before dealing with the present-day grading of wheat offals, it is perhaps advisable to consider the meaning attached to the term " millers' offals " by the milling industry itself. The National Association of Millers was invited in 1913 by the Board of Agriculture to formulate a definition of this term. The following was the result: " That millers' offals, or wheaten offals sold as such, are the products of wheat and of the vegetable substances extracted from the wheats of commerce in the process of cleaning; but the proportion of such extraneous matter shall not exceed the percentage found in the wheats imported into the United Kingdom."

It follows necessarily from this definition that the screenings extracted from wheat, usually amounting to about 3 per cent., may quite legitimately be ground separately and mixed with the offals obtained from the cleaned wheat. As the screenings consist largely of very small berries, together with broken and shrivelled wheat, oats, barley and other seeds, it is clear that the mixed product, when ground, will contain a substantial proportion of material as fine as flour, and this is an important source of the floury particles which find their way into the finer offals.

An examination of the characteristic grades of offals sold on the market at the present time reveals the interesting fact that important changes have been brought about as a result of official control exercised during the later years of the war. With the valuable co-operation of Dr. A. E. Humphries, of Coxes Lock Mill, Weybridge, it has been possible to make a systematic investigation of a very large number of representative samples of wheat offals. In all, eighty-three samples were collected from thirty-one firms trading in all parts of England and Wales. The firms in question were invited to send a sample of every grade sold in ordinary trading.

As a result of sifting experiments carried out by Dr. Humphries, it was found possible to divide the eighty-three samples into seven main groups as follows:—

TABLE II.

Group.	*Size of particle.*	*Number of samples falling into group.*
A	At least 75 per cent. over No. 10 wire sieve	13
B	At least 75 „ over No. 16 wire sieve	18
C	At least 75 „ over No. 24 wire sieve	14
D	At least 50 „ over No. 56 wire sieve	5
E	At least 50 „ over No. 56 wire sieve and at least 25 „ through No. 56 wire sieve ...	28
F	At least 50 „ through No. 56 wire sieve ...	2
G	At least 75 „ through No. 56 wire sieve ...	3

From these results the following points emerge:—

The groups A, B and C are merely sub-divisions of what has hitherto been regarded as one grade of offal, namely, bran. Subsequent chemical analysis confirmed this view. Broad or flaked bran is now produced in large quantities, and this extraction involves a division of straight-run bran. As a consequence, the finer grades of bran sold as medium bran, fine bran and No. 2 bran are obtained.

By far the most striking effect of war-time control, however, is the almost complete disappearance of the grade of offals formerly known as pollards. No sample was received which bore the designation pollards or corresponded with the grade of pollards tested by Wood and Adie in 1917. The term still appears to be used in a very few districts, and it is still also applied to some of the offals imported from the Argentine, but for all practical purposes, it can be said that control destroyed the grade. It is probable that some of this product now finds its way into the fine brans and some, after regrinding, into the middlings. The samples of Group C, for instance, probably contain a proportion of this material, although chemical analysis, together with the fact that these samples only pass in part through the No. 16 wire sieve, establishes the offals in this group definitely as brans.

An examination of the detailed sifting returns for the samples in Group D revealed the fact that they cannot be regarded as constituting a typical or "pure" grade of offals, but rather as a "mixed" grade, intermediate between the finer brans and middlings. Since only five out of the total of eighty-three samples fell into this group, it was felt that no useful purpose could be served in taking them into account in feeding experiments designed to establish the food values of typical grades of offals.

The Group E offals may be taken as representing the average middlings now being produced in this country. The E and F groups differ in respect of the presence of a large number of finer particles in the F samples. Since the latter, however, represent such an extremely small fraction of the offals made and sold in this country, they can, like those of the D group, be left out of consideration when selecting typical grades for feeding trials.

The offals in Group G approximate to the old fine middlings and possess a special interest, although they constitute only a small portion of the total offals made in the country. Two of the samples came from South Wales, and the third from South Devon. In South Wales there is a great demand for high grade flour, whilst the demand for lower grade flours is correspondingly poor. In practice this results in a low extraction of flour from the wheats and the appearance of much low grade flour in the offals. As much as 48 per cent. of these very fine offals will pass through the No. 10 silk sieve. In other words, about half of this grade of offals is in reality low grade flour, and it would be possible to utilise these samples in the making of dog biscuits.

The next stage in the investigation concerned the chemical composition of the various groups of offals. Instead of submitting the whole of the eighty-three samples individually to analysis, composite samples representative of the seven groups were made up, each one containing a correct proportion of the original samples in the groups. The seven composite samples were then analysed by Mr. A. J. Codling in this Institute with the following results, calculated to the dry matter basis :—

TABLE III.

Group.	*Fat.* per cent	*Protein.* per cent.	*Carbohydrate.* per cent.	*Fibre.* per cent.	*Ash.* per cent.
A	5·19	16·32	60·86	11·01	6·62
B	5·30	16·38	60·84	10·87	6·61
C	5·41	16·35	60·90	10·85	6·49
D	5·99	17·75	61·41	9·23	5·62
E	5·68	18·21	65·61	6·28	4·22
F	5·60	17·24	66·44	6·48	4·24
G	4·62	19·52	70·56	2·48	2·82

It will be seen that little difference exists between the results for Groups A, B and C, the denomination of these groups as differing grades of one offal, namely, bran, being thus confirmed. The intermediate character of the Group D offals between bran and middlings is brought out by the figures, as is also the resemblance between the groups of middlings, E and F. The results for Group G lead one to anticipate a high feeding value for these very fine offals.

A study of the sifting results of the eighty-three samples, together with the results of chemical analysis of the seven composite samples, leads to the conclusion that present-day wheat offals may be divided into three main grades, namely, Brans (A, B and C), Middlings (E and F), and Fine Middlings (G). It is of interest, therefore, to compare the analytical results for the following three typical grades :—

TABLE IV.

Grade.	*Fat.* per cent.	*Protein.* per cent.	*Carbohydrate.* per cent.	*Fibre.* per cent.	*Ash.* per cent.
B Bran	5·30	16·38	60·84	10·87	6·61
E Middlings	5·68	18·21	65·61	6·28	4·22
G Fine Middlings	4·62	19·52	70·56	2·48	2·82

It is very clear from the above figures that the classification based on size of particles very efficiently separates the offals into grades which possess sharply differentiated chemical characters. The fine middlings show a high content of carbohydrates, as would be expected from the fact that they contain a large proportion of low-grade flour. The percentage of carbohydrates decreases continuously as the size of the particles increases. The fibre content displays a continuous variation in the reverse sense, being very low in the fine middlings and highest in the bran. A precisely similar variation characterises the ash content.

The amount of protein increases continuously as the size of particle diminishes. In respect of the fat constituent, the percentage is highest in the middlings, and decreases as the particles become either finer or coarser than in this grade. It will finally be noted that the above findings are in substantial agreement with those obtained by Wood and Adie in their work on the composition of pre-control wheaten offals.

Since wheat offals, as made at the present time, had thus satisfactorily been divided into three main typical grades, it now became necessary to carry out digestion trials on samples of these grades. It was hoped in this way to correlate size of particles not only with chemical composition but also with feeding value, and thus to encourage a universal production of offals on a simple and uniform basis. In deciding to continue the investigation in this direction, account was taken of the fact that the milling industry had been out of control for some considerable time, and that the present position as to the grading of offals is one which is likely, substantially, to continue so long as wheat and offals possess approximately the same relative values.

It is not necessary in this article to go into the method of experiment by means of which the digestibility and feeding value of a foodstuff are evaluated. The technique of this part of the work will be discussed fully elsewhere. It may, however, be mentioned that the trials were carried out in duplicate, and wether sheep were employed for the purpose. The offals being tested were fed in weighed amount, together with definite weights of linseed cake and chaffed meadow hay.

Two separate trials were carried out with bran, in order to compare ordinary bran with broad bran from the feeding value standpoint. Broad bran is ordinarily obtained by sifting out the largest flakes from straight-run bran, the remainder constituting medium bran or fine bran. From the broad bran practically all the dusty material has been removed. It is sometimes the practice to pass bran between smooth rollers. In this way "curly bran" is flattened, and the effect may be intensified if the bran is steamed immediately before rolling.

A considerable number of feeders prefer the larger flakes, and, consequently, the miller can command a better price—from 15s. to 35s. per ton more—for the broad bran. It is claimed that broad bran makes a better mash for stock and a more bulky feed when soaked. Horses are said to prefer it and to do better on it, although its analysis does not differ materially from that of ordinary bran.

The broad bran tested in this experiment had been obtained by the simple sifting of straight-run bran. The main object of the comparison was to ascertain whether, from the standpoint of food value, there existed sufficient justification for the higher cost of broad bran and for the extra labour involved in effecting this division of straight-run bran.

For the purposes of the middlings feeding experiment, a large composite sample was made up, representative of the twenty-eight samples in Group E and the two samples in Group F. The whole sample was thoroughly mixed up in a suitable machine.

The sample of fine middlings was prepared so as to be representative of the finest offals obtained from the three representative firms conducting business in South Wales and South Devon.

The tables which follow summarise the results of the investigation into the feeding value of these various grades of offals. The results of simple analysis of the foodstuffs are given in Table V. The only new point which arises from this table lies in the results for the two brans, which display marked similarity. The ordinary bran appears to be slightly richer in protein and carbohydrate, but somewhat poorer in respect of fat. This difference is probably occasioned by the presence of fine particles in the ordinary bran.

TABLE V.

COMPOSITION OF WHEAT OFFALS USED IN FEEDING TRIALS.

(Calculated to dry matter basis.)

	Broad bran. per cent.	*Ordinary bran.* per cent.	*Middlings.* per cent.	*Fine middlings.* per cent.
Protein ...	16·86	17·32	18·38	19 64
Fat	4·59	4·44	5·67	4·33
Carbohydrate ...	59·83	60·71	66·05	70·16
Fibre	11·86	10·87	5·69	2·62
Ash	6·86	6·66	4·21	2·75

In Table VI are given the results expressing the so-called digestion coefficients of the constitutents of the various grades of offals. By the term digestion coefficient is meant the number of parts of a constituent which are digested and utilised by the animal per 100 parts of that constituent consumed. In every case the figures represent the mean of the values obtained for the two sheep.

TABLE VI.

SUMMARY OF DIGESTION COEFFICIENTS.

	Broad bran. per cent.	*Ordinary bran.* per cent.	*Middlings.* per cent.	*Fine middlings.* per cent.
Dry matter ...	57·9	57·0	71·5	75·8
Organic matter...	61·6	60·9	75·4	78·2
Protein* .	75·3	72·3	72·7	74·0
Fat	71·0	71·0	86·0	88·3
Carbohydrates†	62·7	63·5	78·2	80·9
* Protein (corrected)	88·3	87·0	90·0	91·0

† Including fibre.

It will be noted that the digestion coefficients for the constituents of the broad bran and ordinary bran display quite good agreement, leading to the conclusion that there is little to choose between the two brans from the feeding standpoint.

The figures for dry matter, organic matter, fat and carbohydrate show clearly a progressive increase in the digestibility of these constituents with decrease in the size of the particles constituting the offals.

This behaviour, however, is not displayed by the values of the protein digestion coefficients, and there can be little doubt that the protein of bran is almost as digestible as the protein of middlings and fine middlings.

In Table VII are tabulated the percentages of digestible nutrients in the different classes of offals. The results are arrived at by combining the data of Tables V and VI. The starch equivalents for maintenance and production and the nutrient ratios are also given.

TABLE VII.

AMOUNTS OF DIGESTIBLE NUTRIENTS AND FEEDING VALUES.

	Broad bran. per cent.	*Ordinary bran.* per cent.	*Middlings.* per cent.	*Fine middlings.* per cent.
Protein	12·69	12·52	13·36	14·53
Fat	3·26	3·15	4·88	4·26
Carbohydrate* ...	44·91	45·45	56·10	58·88
Maintenance starch† equivalent (lb.)	68·27	68·35	84·02	86·84
Production starch † equivalent (lb.)	49 09	49·20	67·95	79·12
Nutrient ratio‡ ...	4·12	4·19	5·02	4·71

* Including fibre.

† Per 100 lb. dry foodstuff.

‡ This figure gives the number of pounds of digestible carbohydrates and fats (fuel substances) which go with one pound of digestible protein (repair substance) in the foodstuff.

The results in Table VII very clearly substantiate the conclusion already arrived at, namely, that the two brans are equal from the feeding point of view, and that the difference in price between the two foodstuffs cannot be justified on the grounds of feeding value.

The data further emphasise the statement made earlier in this communication, namely, that a simple uniform method of grading offals on the basis of size of particles yields grades which are characterised by a perfectly distinctive chemical composition (both in regard to crude and digestible constituents) and also by the possession of well defined feeding values.

The values of the starch equivalents are throughout higher than those attributed on somewhat speculative grounds to wheat offals by Wood and Adie. The latter investigators did not possess at the time any reliable digestibility data on which to base their calculations.

Attention should be directed to the excellent feeding value possessed by the fine middlings. From the feeder's point of view, it is to be regretted that so little of this class of offals is made in this country at the present time.

In conclusion, the writer would like to tender the thanks of the Institute to Dr. A. E. Humphries for his co-operation in the carrying out of this investigation.

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BARLEY GROWING.

H. HUNTER, M.Sc.,
Ministry of Agriculture for Northern Ireland

BECAUSE of its particular suitability to medium and light classes of soil, its value as a spring-sown crop and the facility with which the produce can generally be disposed of, barley continues to hold an important position in the ordinary farming rotation of a large portion of the country.

Soils.—Barley grows best on well-drained medium to sandy loams, with gravelly sub-soils, or in other words on free working, open, readily-drained soils, and the greater acreage of the crop in England is found in the eastern and southern counties, where soil conditions such as those described prevail. In the northern counties the area under barley is considerably less than in the south, owing both to the heavier soil there prevailing and to the later seasons and consequent tendency of the grain to ripen insufficiently. Even in these counties, however, the selection of earlier ripening varieties for cultivation would tend to minimise the effect of these natural conditions.

Points of Good Malting Barley.—The points of good malting barley are :—(1) Good condition, by which is meant dry, well-handling grain, free from any smell of heating or of mould and with no trace of growing grains; (2) bright colour; (3) absence of cracked or skinned grains and of grains of which the germ has been injured or removed in thrashing; (4) evenness in size of grain; (5) finely wrinkled skin, which denotes good ripening; (6) the grain when cut across should exhibit a white, mealy surface.

It is recognised that soil and climate play an important part in determining the colour and quality of the grain, but with care in harvesting and thrashing many lots of grain which would otherwise be described as of medium quality, can be so improved as to obtain higher prices in the market than they do at present. Evenness in size of grain is a striking feature to the eye, and a little extra care in screening will secure this condition and so increase the selling value of a sample by several shillings per quarter. It is better to have a little good corn in the screenings than a little screenings in the good corn.

Cultivation.—Barley usually succeeds the root crop or another corn crop, its position in a rotation being determined to a large extent by the state of fertility of the land. For two reasons too high a state of fertility is undesirable for this crop: (*a*) on rich soil the straw is liable to be overgrown and will probably become laid with heavy rain, and (*b*) because with overgrowth of straw the grain tends to be thin and "steely" and thus unsuitable for malting.

The cultivation operations, after both roots and stubble, are very simple. The stubble land should be ploughed in autumn or early winter, and the root land immediately the last roots are either carted or eaten off. Once seeding time approaches, a cultivator may be run over the land or, failing this necessity, an ordinary harrow only.

The points to be remembered at this stage are that barley is a shallow-rooted, quickly-growing plant, and to obtain evenness in the composition of the grain—an important condition in malting barley—all cultivation operations should be performed so as to obtain the greatest uniformity possible,

Sowing.—The seed bed should be fine and dry and the seed deposited in the soil at regular depths and distances. It is desirable to sow barley with a seed drill, and, as a general rule, the distance between the rows should not be more than is absolutely necessary. The usual width of drill is 6 in., but on some soils good results are obtained at 4½ in.

While it is inadvisable to sow too deeply, shallow sowing should also be avoided as the plants do not then obtain a sufficiently secure root hold, and with heavy rain and wind will lodge the more readily.

The quantity of seed used varies considerably with the class of soil and the time of sowing, and is affected also by special conditions, such as the existence of large numbers of rooks in the immediate neighbourhood, or the known liability to severe attacks of wireworm and leather jacket. As a general rule 2½-3 bushels is sufficient, but on very light soils this quantity may be slightly increased. When early spring sowing is practised, and still more with autumn sowing, heavier seeding is advisable.

The date of sowing is important. Provided the land is dry and a good fine seed bed can be obtained, the earlier in the season that barley is sown the greater will be the standing power of the straw and the higher the yield and quality of the grain. Granted such soil conditions, February is not too early, and it is frequently noticed that the weather in that month is more favourable than in March, and a good seed bed consequently easier to prepare.

Spring Treatment.—Treatment after sowing is of the simplest description and consists of light harrowing and rolling as soon as the plant commences stooling or tillering. If the crop is attacked by wireworms or leather-jackets, it may be necessary to repeat the rolling at intervals until the attack of these pests ceases or the plants grow too strong to suffer from them.

Charlock, an extremely objectionable weed, is sometimes very abundant in barley fields, and efforts should be made to eradicate it by spraying with copper sulphate. Details as to this method will be found in the Ministry's Leaflet No. 63.

If thistles and docks are present to any extent they should be removed by spudding as early in the season as is practicable.

Manuring.—When barley is sown after a root crop, the land is usually sufficiently rich with the residues of the manures applied to that crop, and the question of further manuring at this stage does not arise.

When sown after another corn crop, however, it is frequently necessary to apply some artificial manure. Unless the particular requirements of the soil are known beforehand, it is safest and most economical to apply a complete dressing, that is one containing nitrogen, phosphate and potash. A dressing which has proved useful is:—

1	cwt.	Sulphate of ammonia	per acre.
2-3	,,	Superphosphate	,,
2-3	,,	Kainit	,,

As barley is a shallow-rooted quickly-growing plant it requires its food material in a readily available form. Thus, of nitrogenous manures, those containing nitrogen in a soluble form are preferable to more bulky and slower acting ones, and the same remark applies to the phosphates, in which case the soluble form, superphosphate, is recommended.

On wold and chalky soils generally, nitrate of soda is sometimes preferable to sulphate of ammonia, when the same quantity in the mixture, namely, 1 cwt., is sufficient. Both of these manures should be used cautiously as they encourage straw development and tend to produce "steely" instead of the "mealy" grain desired by maltsters. In association with phosphates and potash, however, this tendency is very much reduced, and the quantities recommended above can then be usefully and economically employed.

The mixture of artificial manures should be applied to the land previous to sowing and immediately after mixing, when the harrowing before and after the seed-drill will incorporate it thoroughly with the soil.

On occasion it is necessary to apply some stimulating manure to assist the plant over a severe attack by leather-jackets or wireworms, and ½ to ¾ cwt. (but not more) of nitrate of soda or sulphate of ammonia may be used as a top dressing.

When a field is known to be very rich and lodging is feared, a dressing of 2-3 cwt. of superphosphate may be applied at sowing time. This will hasten ripening, and at the same time stiffen the straw and assist materially in filling the grain.

Harvesting.—The actual harvesting operations of the barley crop are very much the same as those employed in the case of wheat and oats. Unlike these two crops, however, barley requires to be fully ripe and all traces of greenness should have disappeared completely from the straw and grain before it is cut. At this stage the grain is quite hard and should exhibit a finely wrinkled skin.

The length of time in the stook or shock will depend somewhat on the weather, and on the extent to which the butts of the sheaves are free from weeds. So far as it is practically possible everything in the sheaf should be thoroughly "killed" before carrying, as the chances of heating in the stack are greater with barley than with other cereals and the results are more serious. There is generally a slight natural heating in the stack, which, provided it does not proceed too far, matures the grain and is to this extent beneficial. All traces of sweating should have disappeared, however, before thrashing, otherwise the grain will exhibit an indifferent colour and will handle badly.

Thrashing.—Thrashing is one of the most important operations in handling the crop, and, as considerable damage may be done at this stage, more than usual care is urged upon growers to prevent unnecessary depreciation in the value of their grain.

The best of the barley crop is used for malting, and its commercial value for this purpose is considerably higher than for any other. Consequently, almost every grower endeavours to reach this standard, and it should only be necessary to point out some of the obvious causes operating against him to secure their correction.

Malting barley is valuable on account of the starch it contains, but this cannot be utilised by the brewer until it is converted into a sugar called maltose—a change brought about in the grain during the early stages of growth of the young plants. It is thus absolutely necessary that in malting barley the germ should not be removed or injured in any way during thrashing. In addition, when any portion of the skin of the barley corn is removed the grain is liable to mould on the malting floor and thereby impart a disagreeable flavour to the malt. Unfortunately grain exhibiting these features is met with frequently, with the result that the buyer either refuses to purchase a sample exhibiting these defects or offers a much reduced figure for it.

One of the principal causes of such maltreatment is the rapidly revolving drum of the thrashing mill, which when set too close to the breast (or concave perforated screen between which and the drum the straw and attached grain passes) will break or skin the grain or remove the germ from it. The thrashed corn should be examined immediately the thrashing mill is working at full speed, and when damage is detected the breast should be set at a greater distance from the drum, an easy alteration for an experienced machine driver to make.

Apart from direct damage done as a result of a badly set drum, skinned and broken grain may be caused by over-feeding or by passing quantities of loose grain through the machine, or, again, by the feeder not opening the sheaves sufficiently before they reach the drum. These are all small errors that can be detected readily and rectified without any serious trouble.

Damage is occasionally caused by the hummeller, but the fault here does not lie so much with this portion of the machine as with too heavy feeding, when the hummeller-case becomes choked with grain, thereby resulting in excessive friction of one grain against another

The tendency to over-thrash, that is, to thrash the grain too closely, is probably a result of the demand for grain of a high bushel weight—a relic of times when the quality of malting barley was judged in this way. This standard is changing, and to-day the buyer places more importance on the uniformity of size of grain and good thrashing, and grain with a small portion of the beard adhering is valued more highly than closely thrashed material.

Bad screening is frequently the result of over-feeding the machine and should be avoided as it operates against evenness in size of grain.

Seed.—The essential character of good seed is that it will grow and produce strong, healthy plants, and it is imperative that farmers before sowing should make themselves sure of the value of the seed they propose using; further, not only should the seed be capable of growing, but it should do so vigorously.

Another point here arises of special application to barley: varieties do not all behave alike on the malting floor; some grow to the length necessary to effect the changes of starch into maltose quicker than others, whilst others require slightly different treatment in regard to the amount of water used or in the extent to which they are turned on the floor. The practical effect of this is that bulks of grain consisting of a *mixture* of varieties are not as valuable to the maltster as those consisting of a single variety. Not only is this so, but it has been shown that *pure* seed of any variety produces more grain per acre than mixed seed and thus on two scores it is important for the grower to sow seed of a single pure variety. Commercial stocks of such seed are already available, and they will naturally increase in quantity in proportion to the demand.

In some parts of the country, and more severely in some years than others, barley suffers from attacks of smut, a disease so familiar to barley growers that it does not require detailed description here.

The presence of smut in a crop means a direct loss of grain varying with the intensity of the attack, but as the spores spread to unaffected grain during thrashing, an additional monetary loss is entailed, as a result of the depreciation in colour and general appearance of the bulk of the grain.

Various means of controlling smut have been suggested, and formalin solution, 1 pint of formalin to 30 gallons of water, sprayed or sprinkled on the grain just before sowing, is one of the most easily prepared and at the same time one of the most effective fungicides.* Although this is an effective control, it is impossible in practice to secure immunity, and the grower is well advised to make it a practice to draw his seed requirements from smut-free crops.

Varieties for Sowing.—Within recent years considerable attention has been directed to the question : Which are the best varieties for malting and at the same time the most remunerative to the grower? Fortunately, it has been found possible to combine high yield, good malting quality and strong straw, and it now only remains for growers to ascertain the suitability of several recently introduced varieties bearing these characteristics for the special conditions of soil and climate with which they have to deal.

Spring-sown' Varieties.—Varieties of spring-sown barleys are divided into two classes, broad and narrow-eared, according to the shape of the ear.

As a rule broad-eared types are best suited to good loams and heavier classes of soil, and the narrow-eared to lighter soils. The broad-eared varieties succeed well in the northern districts as they are earlier ripening than the most valuable of the narrow-eared types.

For a time broad-eared varieties suffered from "necking," or loss by ears dropping off the straw on ripening or as a result of heavy winds, but several new forms have been bred and introduced into commerce in which this defect has been remedied (see below).

Narrow-eared Varieties.

ARCHER.

Grain -	Not very large, colour rather grey, finely wrinkled skin.
Straw -	Short and wiry, ear very seldom detached from the straw either by wind or in handling during harvest.
Soil and Climate	Suits a wide range of soils but is perhaps best on light and medium loams ; on heavier soils is inclined to be late in ripening.
Remarks	A prolific variety, generally producing good malting samples ; on poor soils it succeeds better than any other type.

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* Leaflet No. 328 *(Smut in Oats and Barley).*

SPRATT-ARCHER.

Grain -	Slightly larger and brighter coloured than Archer; finely wrinkled skin.
Straw -	Similar to Archer, but somewhat stiffer; leaves finer.
Soil and Climate	In regard to soil, generally similar to Archer, but will probably succeed on richer soils better than that variety.
Remarks	A hybrid variety obtained by crossing Archer and Spratt; more prolific and of higher malting quality than Archer and earlier ripening.

Broad-eared Varieties.

GOLDTHORPE.

Grain -	Large and bright coloured.
Straw -	Long and generally erect, but becomes brittle on ripening and the ears are then liable to break off.
Soil and Climate	Suited to heavy loams and later districts.
Remarks	One of the best broad-eared varieties in regard to both yield and malting quality. Earlier ripening than Archer and slightly earlier than Spratt-Archer.

PLUMAGE-ARCHER.

Grain -	Large, good colour, and finely wrinkled skin.
Straw -	Erect and not so long as Goldthorpe, and the ears are not liable to fall off the straw when ripe.
Soil and Climate	Suited to good and heavy loams, and, as it is earlier ripening, to later districts.
Remarks	A hybrid variety, raised by crossing Plumage, a broad-eared barley, and Archer. In yield and quality occupies a leading position amongst present-day varieties.

ARCHER-GOLDTHORPE.

Grain -	Large, good colour, and very finely wrinkled skin.
Straw -	Short, erect and stiff, and ears are not liable to break off the straw when ripe.
Soil and Climate	Suited to good and heavy loams, and, as it is distinctly early ripening, to late districts.
Remarks	A hybrid variety obtained by crossing Archer and Goldthorpe. In yield not equal to Spratt-Archer, but in quality it equals or possibly exceeds that variety. Should succeed well on heavy soils in late districts.

MALTSTER.

Grain -	Large, good colour.
Straw -	Fairly long and erect.
Soil and Climate	Suited to good and heavy loams and to late districts.
Remarks	A hybrid variety obtained by crossing four varieties. Except on a few soils it is not equal in yield to narrow-eared forms or to some of the more recently introduced broad-eared forms. Malting quality good.

SPRATT

Grain -	Large and coarse.
Straw -	Fairly long, erect and stiff.
Soil and Climate	Especially well suited to soils with large quantities of peaty matter in their composition.
Remarks	Almost entirely a feeding barley on soils such as those mentioned; this variety produces very heavy crops but the quality of the grain is poor and is usually only fit for feeding.

1917.

Grain -	Large and good colour.
Straw -	Fairly long, strong and stiff. Ear erect and free from "necking" or breaking off the straw.
Soil and Climate	Suits a wide range of soils.
Remarks	A prolific form, with undoubtedly good standing straw. Quality varies considerably with the soil on which the crop is grown; somewhat inclined to coarseness.

Autumn-sown Varieties.—In some districts it is the custom to sow barley in the autumn, and for this purpose varieties of six-rowed types are commonly used, mainly on account of their winter hardiness.

Varieties of this class are distinguished from those sown in the spring by the character of the ear in which there are six rows of fully developed grains instead of the usual two. Two well-marked divisions of winter varieties exist, one similar to the broad-eared varieties in the two-rowed classes in so far as the grains are set closely together on the stalk of the ear, and the other similar to narrow-eared varieties in the greater distance between the grains on the ear stalk.

Both divisions are usually known by their botanical names, *Hordeum hexastichum* and *Hordeum vulgare*, but the latter has in addition the much commoner names, "bere" or "bigg."

Dense ears (analogous to broad-eared varieties).

HORDEUM HEXASTICHUM.

Grain -	Fairly large.
Straw -	Short, stiff and wiry with a tendency to become brittle when fully ripe.
Soil -.	Is probably best suited to good heavy loams.
Remarks	A good winter-hardy variety which produces heavy crops of grain of from medium to very fair quality.

Lax ears (analogous to narrow-eared varieties).

HORDEUM VULGARE (Bere or bigg).

Grain -	Fair size but somewhat uneven in shape owing to the twist in the four lateral rows of the ear.
Straw -	Medium length, wiry.
Soil -	Suited to a varied range of soils provided they are well drained.
Remarks	A good winter barley variety producing heavy crops of grain of from medium to very fair quality.

The grain of both classes of winter barley is liable to be thin and not, as a rule, of particularly good malting quality, but on suitable soils heavy crops are produced which, if not up to malting standard, can be utilised with advantage for stock feeding.

Winter barley resembles the varieties usually sown in spring in its inability to exist in badly-drained soils, and, as it has naturally to live through the wettest months of the year, this essential condition of well-drained soil must not be overlooked.

* * * * * *

LIVE STOCK IMPROVEMENT IN ENGLAND AND WALES IN 1922-23.

THE Ministry's Live Stock Scheme has now been in operation for nine years, and the progress made during a period of exceptional difficulties indicates that its objects and methods are being increasingly appreciated by the farming community. The Scheme aims at grading up the inferior stock of the country by the introduction of more systematic and careful methods of breeding; this end is being achieved by educating farmers to the use of sound pedigree sires and to the keeping of records of the milk yields of their cows, and financial assistance is provided to bring these methods within the reach of the smaller farmers. The progress of the Scheme on these lines may be gauged from the figures given in the tables in the present report for 1922-23 (1st April-31st March).

BULL AND BOAR SCHEMES.

YEAR.	BULLS.			BOARS.		
	No. of		Total Animals.	No. of		Total Animals.
	Societies.	Individuals.	Bulls.	Societies.	Individuals.	Boars.
1914-15*	369	43	497	115	—	115
1915-16	489	28	633	180	—	193
1916-17	543	15	659	186	15	216
1917-18	578	14	710	172	92	264
1918-19	604	7	721	156	167	350
1919-20	568	6	675	120	225	399
1920-21	561	6	668	185	285	441
1921-22	726	3	847	113	416	550
1922-23	831	1	947	93	451	569

* Including the period 1st February, 1914—31st March, 1914.

Bulls.—It is very satisfactory to find that notwithstanding the agricultural depression there has again been a marked increase in the number of premium bulls located under the Scheme during the year ended 31st March, 1923; 947 bulls were located as compared with 847 during the previous year, and of these no fewer than 553 were Shorthorns, followed by 94 Lincoln Red Shorthorns. As a result of the drop in the value of stock there was a general decrease in the average prices paid for all breeds, the general average price falling from £72 10s. 5d. in 1921-22 to £62 11s. 9d. The highest price paid for a bull provided under the Scheme was £273 for a Hereford bull, while 57 cost £100 or over. There was a marked increase in the number of service fees of 5s., and the numbers of the higher fees were on the whole well maintained. The number of bulls serving at the popular fee of 5s. was 430, while 274 served at higher, and 212 at lower fees. Premium bulls and their progeny have again scored many successes at Shows. As an instance it may be mentioned that a Shorthorn bull provided by one of the Bull Societies has during the 1922 Show Season won 8 champion cups, 2 reserves for cup, 13 first prizes, 8 second prizes and 2 third prizes.

Results of the continued use of good sires are now becoming apparent in districts where the Scheme has been in operation for some time. For example, a large dealer in Yorkshire recently expressed the opinion that the improvement effected by the Scheme had raised the value of the cattle bred in his district by fully £3 per head.

NUMBER AND AVERAGE PRICES OF BULLS.

Breed.	1914-15.				1921-22.				1922-23			
	No.	Price.			No.	Price.			No	Price		
		£	s.	d.		£	s.	d.		£	s	d
British Friesian .	1	37	0	0	7	78	18	7	6	77	15	8
Devon	16	41	0	0	70	64	9	2	90	59	10	3
Guernsey	—	—			6	54	4	2	7	53	9	3
Hereford	63	33	0	0	78	68	15	2	84	58	3	4
Linc. Red	33	32	0	0	89	73	1	8	94	63	14	11
Shorthorn	337	38	0	0	492	76	5	10	553	64	16	3
Red Poll	—	—			1	78	15	0	1	78	15	0
South Devon	6	37	0	0	20	69	5	2	17	58	11	6
Welsh Black	35	29	0	0	60	57	2	7	64	52	2	11
Other Breeds	6	28	0	0	—	—			—	—		
All Breeds ...	497	36	0	0	823	72	10	5	916*	62	11	9

* 917 bulls were located, but grants in respect of 31 were in suspense at the end of the year.

Service Fees.

Year.	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	9/-	10/-	Over 10/-
1914-15	265	57	41	42	3	88	—	—	—	—	1	—	—	—	—	—
1921-22	46	38	26	74	7	346	1	48	3	6	160	6	4	2	51	6
1922-23	50	40	28	84	10	430	3	53	2	10	141	7	8	2	45	6

Boars.—The progress made by the Boars' Scheme during the year ended 31st March, 1923, has been slight as compared with the marked progress reported for the preceding year, but new ground has been broken and there is evidence that the Scheme has led to marked development of the pig-breeding industry in certain districts. For instance, reporting on a boar located at Alvechurch, Birmingham, the Live Stock Officer stated that the location of a premium boar had been followed by the introduction of at least 15 other pedigree boars in the district. Of the 569 boars located 199 were of the Large White breed and 141 of the Large Black, followed by 77 of the Middle White breed. As in the case of bulls there was a general decrease in the average prices paid for the various breeds, the general average price being £15 0s. 4d. as compared with £18 3s. 0d. for the previous year. The highest figure for the year is represented by a Gloucestershire Old Spots which had an estimated value of £63. The service fees showed a relaxation of their upward tendency, but there was a substantial increase in the number of fees of 5s., 300 boars serving at this fee, 172 at higher, and 74 at lower fees.

Subsidised boars and their progeny have again been very successful at Shows, and the following typical instance may be of interest. At the fourth Annual Show held at Keresley on the 24th August, 1922, premium boars, sows served by premium boars, and the progeny of premium boars carried off five first prizes, four second, three third and one special prize, leaving for the other pigs one second, one third and one special prize only.

NUMBER AND AVERAGE PRICES OF BOARS.

Breed.	1914-15.				1921-22.				1922-23.			
	No.	Price.			No.	Price.			No.	Price.		
		£	s.	d.		£	s.	d.		£	s.	d.
Berkshire	10	8	0	0	11	23	19	10	11	18	2	3
Cumberland ...	-		—		32	17	11	10	30	16	5	0
Essex	—		-		7	33	11	5	4	23	7	6
Glos. Old Spots ...	7	7	0	0	51	21	4	4	37	21	8	0
Lincoln Curly Coat ...	4	8	0	0	24	13	0	4	31	12	3	10
Large Black	18	7	0	0	157	17	3	6	141	14	12	7
Large White	61	7	0	0	167	17	5	1	199	13	13	10
Large White Ulster ...	—		—		—		—		2	16	0	0
Middle White	12	7	0	0	62	19	4	3	77	15	11	7
Tamworth	—		—		1	17	0	0	1	20	0	0
Wessex Saddleback ...	—		--		11	22	16	11	13	16	2	3
All Breeds ...	115	7	0	0	523	18	3	0	546*	15	0	4

* 569 boars were located but grants in respect of 23 were in suspense at end of year.

Service Fees.

Year.	2/-	2/6	3/-	3/6	4/-	4/6	5/-	5/6	6/-	6/6	7/-	7/6	8/-	8/6	10/-	Over 10/-
1914-15	21	62	10	5	6	—	2	—	—	—	—	—	—	—	—	—
1921-22	1	10	13	13	36	6	245	1	42	5	7	111	3	3	22	10
1922-23	—	7	12	13	37	5	300	—	51	4	2	99	—	4	13	1

Sheep.—The Scheme for the improvement of Welsh Mountain Sheep, to which financial assistance was first given by the Ministry in 1919-20, is growing in popularity. During the year under review grants at the rate of 3s. 4d. per ewe served, up to a maximum of £10, were made to 14 societies in respect of 17 approved pedigree rams; 1,041 selected ewes were served, being an average of 61 per ram. In accordance with the Regulations the ram, ewes and progeny are required to be ear-marked. The average hiring fee of the rams was £9 15s. 4d., and the average service fee was 1s. 2d. The rams hired were of the best quality, including prize-winners at the Welsh National and County Shows, and the Scheme is greatly appreciated in the districts for which it is provided.

Milk Recording.—During the recording year 1st October, 1921, to 1st October, 1922, the Milk Recording Section of the Scheme has continued to make steady progress, three societies and 19,000 cows having been added. The Scheme is now operating in practically every county in England and Wales. The following table shows the progress made as regards the number of societies, members and cows since the inauguration of the Scheme in 1914:—

MILK RECORDING.

	*Year.**	*Societies.*	*Members*	*Herds.*	*Cows.*
1st April to 31st March	1914-15	16	264	306	7,331
	1915-16	20	350	398	9,811
	1916-17	22	441	495	12,950
	1917-18	25	503	555	14 404
1st October to 30th September	1917-18	27	639	708	19,793
	1918-19	38	1,191	1 332	37,880
	1919-20	46	2,075	2.312	61,323
	1920-21	52	3,328	3.664	97,903
	1921-22	55	8,949	4,362	117 023

* Prior to 1st October, 1917, there was no uniform year for Societies.

It will be observed that the tendency is for societies to grow in size rather than in number. This is due to the fact that the majority of the societies have now extended the scope of their operations so as to cover the whole of their respective counties. In other cases where there are several small contiguous societies endeavour is being made to amalgamate them so as to form strong county societies. There are 14 societies with a membership of over 100, 19 with a membership between 50 and 100 and 22 with less than 50 members. A table showing certain particulars of all the societies is given in the table on p. 618.

Increase in Average Yields.—The annual returns furnished by the 55 societies for the recording year under review show that of the 117,023 cows and heifers recorded, 54.1 per cent. were cows which had been retained in the herds for the full year, and the average yield for these full-year cows was 6,670·81 lb.—an appreciable advance on the average for the previous year when the full-year cows, which represented 49 per cent. of the cows and heifers recorded, gave an average of 6,562·95 lb. The averages shown in the following statement indicate that the yields of milk-recorded herds are steadily increasing year by year:—

Comparison of Average Annual Yield for Societies for the Last Four Milk-Recording Years.

Year 1st Oct. to 1st Oct.	No. of Societies.	Particulars of all Cows and Heifers recorded.			Particulars of Cows recorded for full year.		
		No. of Cows and Heifers.	Total Yield (gal.).	Average Yield (gal.).	No. of Cows.	Total Yield (gal.).	Average Yield (gal.).
1918-19	38	37,880	16,204.941	450	17,989	10,543,516	579
1919-20	46	61.323	29.344,887	479	27.266	17,363,347	637
1920-21	52	97,903	48,512,380	495	48,248	30,892.620	640
1921-22	55	117,023	60,463,617	517	63,318	41,208,073	65

The following figures, taken from the records of the Oxfordshire Society, show how the average yield per cow is being raised in certain herds, and are typical of what is occurring in many herds. The figures show the average yield per cow during the first year of recording as compared with the average yield during the year ended 1st October, 1922.

Herd.	Average Yield per Cow during Year.			
	Year.	*lb.*	*Year.*	*lb.*
A	1916-17	5,204	1921-22	6,588
B	1915-16	7,464	,,	9,507
C	1918-19	6,320	,,	8,730
D	,,	6,600	,,	7.831
E	1919-20	5,545	,,	8,128
F	,,	6,267	,,	8,070

As a further instance it may be mentioned that in Montgomeryshire a smallholder with 25 acres of poor land, by careful selection, had six cows averaging 1,048 gallons, and that he attributed his success mainly to selection and to advice given on rations.

Issue of Certificates.—The number of milk record certificates issued to members was 2,432. This number represents 2.08 per cent. of the *total* number of cows recorded, and 3.84 per cent. of the number of cows which were recorded for the full year. Of the 2,432 certificates issued only 228 were for yields of less than 6,000 lb., while 627 certificates, *i.e.*, over a quarter of the whole number, were for yields of 8,000-9,000 lb.

The sixth volume of the Ministry's Annual Register of Dairy Cattle was issued in July last. It contains particulars of 1,499 cows (belonging to 305 members) in respect of which certificates have been issued by the Ministry, showing that they have yielded 8,000 lb. or over of milk during the milk recording year ended 1st October, 1922, or an average of 6,500 lb. for that year and one or more preceding consecutive years. Fourteen recognised breeds or types are represented in the sixth volume, and there are in addition 93 cross-bred cows (*i.e.*, cows which do not conform to one recognised breed or type) whose milk yields have justified their inclusion under the standard required. Of the 1,499 cows entered in the sixth volume 1,271 gave over 8,000 lb. of milk during the year, and 228 were entered on an average of 6,500 lb. or over. Of the 1,271 cows which were entered on the one year's yield 554 gave between 8,000 and 9,000 lb.; 332 between 9,000 and 10,000 lb.; 181 between 10,000 and 11,000 lb.; 99 between 11,000 and 12,000 lb.; 44 between 12,000 and 13,000 lb.; 26 between 13,000 and 14,000 lb.; 11 between 14,000 and 15,000 lb.; 6 between 15,000 and 16,000 lb.; 4 between 16,000 and 17,000 lb.; 5 between 17,000 and 18,000 lb.; 4 between 18,000 and 19,000 lb.; 3 between 19,000 and 20,000 lb.; 1 between 23,000 and 24,000 lb.; and 1 over 24,000 (viz., 24,465½ lb.).

This issue of the Register contains the first list of cows in respect of which certificates of merit have been issued, certifying that such cows have yielded not less than 24,000 lb. of milk over a period of three consecutive years and have calved at least three times during that period. Another interesting feature of the volume is the addition of a Bull Section, which is intended to be of use to farmers who desire to obtain the services of bulls of proved milking strain. Bulls are eligible for this section if their dams and sires' dams have been entered in the Register, or if they have two or more daughters so entered. It is hoped that as the Register becomes more widely known and its object more generally understood, farmers will avail themselves of the useful information which it contains.

Calf Marking.—The Ministry's calf-marking scheme, the adoption of which is optional, has now been taken up by all but one of the societies. The number of animals marked under this Scheme during the year was 11,517, as compared with 7,831 during the preceding year.

Cost of Milk Recording.—As regards the financial side of milk recording it is satisfactory to find that the cost of recording no longer shows the marked tendency to increase which has been noticed in previous years, and it may reasonably be expected that as the societies expand and become more efficiently organised a reduction in cost will result.

Commercial Value of Milk Recording.—The commercial value of milk recording continues to be demonstrated by the prices realised at sales for recorded non-pedigree cattle and their progeny, and the following are particulars of some of the sales which have been reported to the Ministry.

At a sale on the 29th November, 1922, at Twyford, non-pedigree Dairy Shorthorns realised an average price of 49 guineas for 46 cows and heifers, the highest prices being 71, 70, 65, 64 and 62 (three times) guineas. The Live Stock Officer stated that " Recording increased the value at least £15 per cow," and the Press opinion was that " the sale was one of the most successful of its kind this year."

At the Lancashire Milk Recording Society's fifth Autumn Show and Sale on the 7th November, 1922, 70 non-pedigree cows and heifers, mainly Dairy Shorthorns, realised an average price of 45 guineas, the highest prices being 100, 81, and 80 (twice) guineas.

At the autumn show and sale promoted by the Cumberland and Westmorland Milk Record Sales Association at Penrith, on the 9th November, 1922, 30 non-pedigree Dairy Shorthorn cows and heifers averaged 47 guineas, the highest prices being 115, 100 and 75 guineas.

At a sale on the 2nd October, 1922, of the herd of a member of the Berkshire Milk Recording Society, 59 non-pedigree Shorthorn and British Friesian cows realised an average price of 47 guineas, the highest prices being 92, 90, 74 (twice), 72 (twice), and 70 guineas. The Live Stock Officer reported that the general opinion was that recording had increased the value at least £15 to £20 per head.

APPENDIX A.—STATEMENT giving particulars of 55 Milk Recording Societies operating during the year ended 1st October, 1922.

(The Societies are arranged in order of total number of animals recorded.)

NAME OF SOCIETY.	Number of Members.	Number of Herds.	Total No. of animals recorded.	No. of cows recorded for full year.	Av. yield of cows recorded for full year.
					lb.
Essex County	188	213	7,467	4,095	7,166
East Sussex	185	217	6,317	3,302	6,841
Berkshire	114	134	5,161	2,756	6,580
Hampshire	126	145	4.704	2,366	6,668
North West Wilts.	95	107	4,636	2,931	6,438
Dorset	68	99	4,468	2,466	5,796
Kent	146	167	4.361	2,059	6,966
Hertfordshire	139	151	4,303	2,195	6,896
Surrey	155	164	4,052	2,035	6,646
Yeovil	109	129	4,000	2,436	6,424
Salisbury and District (Wilts.)	59	86	3,941	2,463	7,108
Norfolk	139	160	3,840	2,347	6,810
Lancashire County	135	142	3,513	1.570	6.703
Oxfordshire	95	103	3,350	1,765	6,390
West Sussex	90	100	3,085	1,822	6,925
Warwickshire	121	130	3,043	1,480	6,733
Suffolk	105	118	2.430	1.545	6,790
South Devon	95	103	2,423	1,094	5,956
Leicester	80	83	2,176	1,114	6,953
Northants	79	90	2,120	1.103	6,312
Shropshire	71	79	2,084	1.411	6,772
Cambridge and District	79	86	2,083	1,120	7,248
Cheshire County	57	63	2,017	1,043	6.639
Cumberland and N. Westmorland	142	142	2,005	970	5,971
Yorkshire	113	121	1,992	918	7.420
Staffordshire	74	77	1,954	1,111	6,986
Nottinghamshire and District	52	57	1,676	715	6,810
Derby and District	42	45	1,509	677	7.049
Bristol and Bath	78	79	1,503	805	6,664
Buckinghamshire	53	59	1,407	707	7,235
Denbighshire and Flintshire	72	73	1,392	846	6,644
Worcestershire	58	60	1,389	652	6.556
Cadbury (Somerset)	46	56	1,232	696	6,336
Warminster and Mere (Wilts.)	26	29	1,227	823	6,434
Tees Valley (Durham)	36	44	1,120	517	7,242
Peak (Derby)	36	36	949	291	6,829
Frome and District (Somerset)	23	23	924	697	6.211
East Devon	51	53	899	458	6,054
Kendal and S. Westmorland	40	41	828	463	6,011
Bedfordshire	31	32	744	363	6,991
Campden, Moreton and District (Glos.)	34	36	740	467	6.328
North Somerset	27	31	696	452	6.538
Anglesey and Carnarvonshire	52	53	653	394	5,561
United Counties	40	41	652	382	6,480
Lincolnshire	30	32	645	372	6,346
Cornwall	42	43	630	329	5,612
Allendale (Northumberland)	35	36	601	344	6,775
Shepton Mallet and District (Somerset)	15	17	596	439	6,017
Monmouthshire	28	30	588	198	6,257
Cheltenham and District (Glos.)	23	25	534	370	7,564
Melton Mowbray and District (Leic.)	24	24	527	287	6.063
Hertfordshire	24	24	487	296	6,763
Quedgeley and District (Glos.)	30	31	484	287	6,862
Montgomeryshire	27	27	478	243	5,865
Highbridge and District (Somerset)	15	16	388	228	6,467
TOTALS	3.949	4,362	117,023	63.318	6,670

At Amberley Court, Monmouth, on the 5th September, 1922, the herd of a member of the Monmouthshire Milk Recording Society was sold by auction. The herd consisted of 26 pedigree Shorthorn cows and heifers. 8 pedigree Shorthorn calves, 12 non-pedigree Shorthorn cows and heifers, and 2 non-pedigree Shorthorn calves. The highest prices for the pedigree cows were 110 guineas (twice), 100 guineas and 92 guineas, and for the pedigree calves 32 and 30 guineas. For the non-pedigree cows the highest prices were 160, 100 and 95 guineas and for the non-pedigree calves 26 guineas. The average price for the 12 non-pedigree cows was 67 guineas as against 57 guineas for the 26 pedigree cows—good evidence of the value of milk recording.

At the spring sale of Dairy Shorthorns at Penrith on the 11th May, 1922, a non-pedigree recorded cow, the property of a member of the Cumberland and North Westmorland Milk Recording Society, realised £108.

The following are the principal memoranda used in connection with the live stock operations of the Ministry, and copies of them can be obtained free of charge on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Leaflet 282... ...	Scheme for Improvement of Live Stock.
Leaflet 146... ...	The Value of Records of the Milk Yields of Cows.
No. 609/T.L. (L.2)	Bull Grant Regulations.
No. 392/T.L. (L.4)	Milk Recording Regulations.
No. 446/T.L. (L.11)	Boar Grant Regulations.

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LIGHT HORSE BREEDING IN 1922-23.

The operation of the Light Horse Breeding Scheme during the season 1922 (1st April-31st March) followed the usual lines except that for reasons of economy the number of Ministry's Premiums was limited to 15, and only 57 instead of the usual 85 King's Premiums were awarded at the Thoroughbred Show in 1922 owing to the lack of stallions of sufficient merit to justify the full number of awards.

Premiums awarded for 1922 Season.—The following Premiums were awarded for the season 1922:—12 Super Premiums, 45 King's Premiums, and 15 Ministry's Premiums (all thoroughbred horses except 3 Ministry's Premiums, which were awarded to 1 Hunter Stallion and 2 Cleveland Bay Stallions), 5 Riding Ponies, 18 Welsh Cobs, 3 Welsh Roadsters, 4 Dales Ponies, 5 Fell Ponies, 10 New Forest Ponies, and 43 to Mountain Pony Stallions in Wales.

Service Season, 1922.—The numbers of mares served by the various classes of stallions were as follows:—

		No. of Mares Served.	*Average per Stallion.*
12 Super Premiums...	...	855	71
45 King's Premiums ...	...	3,034	67
15 Ministry's Premiums...	. .	872	58
5 Riding Pony Premiums	...	205	41

Foaling Results from Service Season 1921.—The foaling percentage of stallions is calculated upon Returns furnished to the Ministry by the mare owners, and the results from the 1921 Service Season were as follows:—

		No. of Mares served in 1921.	*No. of Returns furnished to Ministry.*	*Average Percentage.*
12 Super Premiums...	...	941	883	51
48 King's Premiums	...	3,407	3.154	54
26 Ministry's Premiums	...	1,398	1,228	54
5 Riding Pony Premiums...		263	243	60

The highest percentage (71) was obtained by two stallions "Ednam" and "Cock-a-Hoop," owned respectively by Messrs. T. and H. Ward and Lt.-Col. Sir Merrick R. Burrell, Bart., C.B.E.

Thoroughbred Show, 1923.—The Annual Show of Thoroughbred Stallions for the purpose of awarding Premiums to stallions for the service season 1923 was held at the Royal Agricultural Hall on 27th and 28th February and 1st March, and the Judges were Messrs. Ernest Bellaney and Romer Williams. The number of entries was 87, one less than in 1922. A satisfactory feature of the Show was the entry of 24 new stallions, of which 9 were considered to be of sufficient merit to receive an award. One of these, "St. David," the property of H.M. the King, took third place among the Super Premium winners. The full number (60) of Premiums (including 12 Super Premiums) was awarded, and the King's Cup was won for the fourth year in succession by "Gay Lally" belonging to the Compton Stud, the Reserve horse being "Scarlet Rambler" as in the previous three years.

Horse Breeding Act, 1918.—During the licensing year 1st November, 1921, to 31st October, 1922, there was a marked decrease in the number of stallions licensed under this Act, the number being 3,479 as compared with 3,816 in the preceding year. There was, it is satisfactory to note, a proportionately greater decrease in the number of stallions for which licences were refused. There were 165 refusals, 16 of which were after appeal, the numbers for the previous year being 244 and 18 respectively.

Of the 3,479 licensed stallions, 3,129 were pedigree animals and the remaining 350 were horses that were not entered or accepted for entry in any recognised Stud Book.

The following tables show the number of stallions of each breed concerned that were licensed or rejected, and the number refused licences in respect of the various prescribed diseases or defects :—

NUMBER OF STALLIONS LICENSED OR REFUSED.

	Pedigree.		*Non-Pedigree.**	
Heavy.	*Licensed.*	*Refused.*	*Licensed.*	*Refused.*
Shire	2,052	106	122	8
Clydesdale	237	16	7	1
Suffolk	216	8	2	1
Percheron	47	—	2	—
Others	—	—	80	5
Light.				
Hackney	213	5	41	2
Thoroughbred	150	7	4	—
Arab	17	1	3	-
Hunter	4	—	3	—
Cleveland Bay	9	—	—	—
Yorkshire Coach	2	—	—	—
Welsh Roadster	5	—	1	--
American Trotter	1	--	4	-
Others	—	—	18	—
Ponies (including Welsh Cobs)	176	3	63	2
Totals	3,129	146	350	19

* Non-pedigree stallions are arranged as far as possible under types.

NUMBER OF STALLIONS REJECTED UNDER THE PRESCRIBED DISEASES AND DEFECTS.

Roaring	37	Defective Genital Organs	6
Whistling	39	Springhalt	11
Sidebone	29	Shivering	8
Cataract	15	General Unsuitability	1
Ringbone	16		
Bone Spavin	3	*Total*	165

Twenty-eight appeals were made against refusals of licences, and in 12 cases these were successful.

Notwithstanding the decrease in the number of stallions licensed the Ministry has information which suggests that the number of unsound stallions which formerly travelled at very low fees, and which constituted the most serious hindrance to grading up of horse breeding, have been practically eliminated from the road. Since the Horse Breeding Act came into force the Ministry's Inspectors and Live Stock Officers and the Police have endeavoured to secure observance of the Act by stopping stallions on the road and requiring the production of the licences, and in cases where the Regulations have been infringed proceedings have been taken by the Police. The fact that there was a marked decline in the number of prosecutions is evidence of a more general knowledge of and compliance with the Act on the part of stallion owners.

National Stud.—The operations of the National Stud during the year ended 31st December, 1922, continued to be satisfactory, under the able direction of Capt. Greer. The profit for the year amounted to approximately £3,000, bringing the accumulated Trading Profit up to £33,550 since the establishment of the Stud in 1916. It is very satisfactory to record that the National Stud headed the list of Winning Breeders for the year 1922 with 25 horses winning 42 races of a total value of £32,939.

During the year 1922, 15 yearlings were sold at an aggregate gross sum of £17,951, i e , an average of £1,197, which, in view of the general fall in prices, may be considered satisfactory.

Both of the stallions at the Stud, "Silvern" and "White Eagle," had full subscription lists, and the performances of the stock of the mares at the Stud, which number 37, during the racing season of 1922 testify to the excellence of the brood mares.

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GRADE "A" MILK.

A. T. LORAM.

IN the July number of this *Journal* appeared an illustrated article on this subject, and the writer of the article asked and answered the question, Is Grade "A" Milk worth while? The present writer would like to add his emphatic "Yes" to that answer, and readers may be interested in the methods of another licensed producer of Grade "A" (Tuberculin Tested) Milk.

No season of recent years has had hotter spells than the summer now past. It has afforded an opportunity for proving that given *clean milk* there is no difficulty in keeping it sweet 36 hours and longer on the hottest thundery day. The conditions are :—

1. *Clean Cows*, groomed free of all dirt on flanks and udders. Teats and surrounding parts should be wiped clean with a wet cloth immediately before milking.

FIG. 1.—Cowshed for 30 Cows, with Bull Pen and Calf Stal

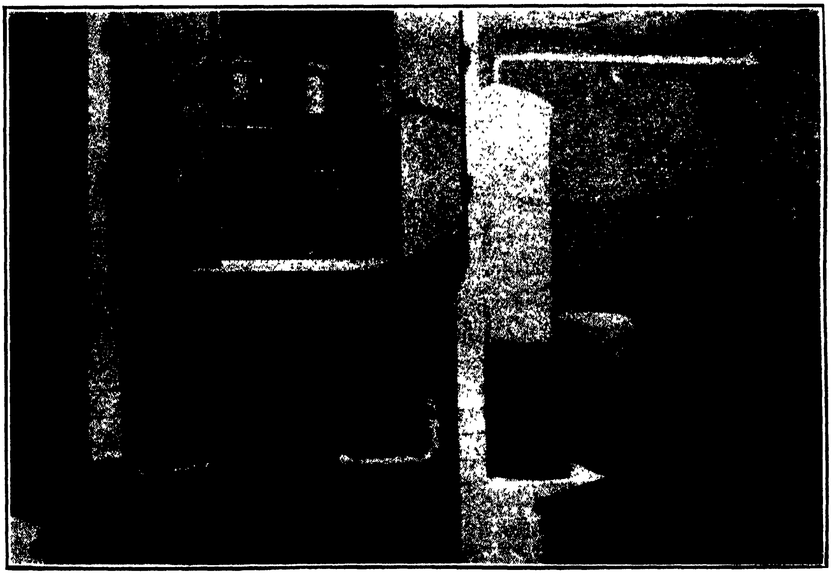

FIG. 2 —Sterilizing Room adjoining Milking Shed.

FIG. 3. Showing the arrangement of the Milk Room

2. *Clean Milkers* clothed in washable caps and overalls, using domed pails, clean stools, and washing their hands with soap and water between milking each cow.

3. *Clean Vessels* which have been sterilized by steam heat and kept in a dust-free chamber till needed.

4. *Milk Removed from Cow House* as quickly as possible, passed over a cooler and bottled immediately; or, if sent to a depot for bottling, covered in an airtight churn.

In these four conditions lie nine-tenths of all that is involved in high-grade milk production. Expensive cowhouses and fitments are not essential. At the same time good results are more easily obtained if the milking shed has an impervious washable floor. and limewashed walls and ceiling.

The Cowshed.—The writer's cowshed is here shown (Fig. 1) The beds measure 5 ft. from the edge of the crib to the edge of the gutter; the width between divisions is 4 ft. 3 in.; the width of the gutter is 18 in., with a fall towards the path. Inside of these measurements big Devon cows find room and comfort, tied with the free-moving yokes shown in the picture. At the same time practically all droppings fall into the gutter free from the bed.

Sterilizing Room.—Adjoining the milking shed is the sterilizing room (Fig. 2). It contains a trough for washing milk vessels, and is used for nothing else. There is also a steaming block on which cans can be inverted, so that a steam jet reaches every crevice. A cupboard is arranged over the heating apparatus so that buckets, milk cooler, strainers, etc., can be thoroughly dried after steaming. The cupboard is frequently limewashed and is fly and dust proof. Doors are made of asbestos cement sheets on light iron frames. A 40-gallon cylinder provides abundant hot water which can be raised to steam at short notice with small consumption of fuel by an ordinary greenhouse stove. The one fire successfully meets all requirements.

Milk Room.—An inexpensive milk room is conveniently situated outside the cowshed, and yet not too far for the milkers to go. Fig. 3 shows the arrangement of it.

A dial and weighing bucket is suspended from the ceiling. At the top is an 8-gallon receiving tank with bead rim. Over this is stretched a sheet of thick straining material secured by a band of solid rubber (perambulator tyre) which is nipped into place with a lever such as is used for putting on motor tyres. A wide shallow stretch of strainer makes a better filter than a narrow deep one. From this tank milk falls slowly over the cooler and thence into the churn beneath. A concrete platform 18 in. high makes convenient the lifting of buckets to the strainer. No dust-making operations or dung moving is allowed anywhere near while milking and cooling are being done. No dirt of any kind is allowed to accumulate near the milking shed. A cart stands in the yard to receive all sweepings, and this is removed to the fields daily. This and the use of a little chloride of lime now and then has reduced the fly population to a minimum.

As a result of care in details such as these, the writer has been able to get some very low bacterial counts when samples of milk are sent to Reading College.

Public Opinion.—Readers, however, will ask: Does the British Public think Grade "A" Milk worth while? To this a qualified answer must be given. Thinking people in increasing numbers appreciate the efforts of the Ministries of Health and of Agriculture to ensure the provision of clean milk, but it must be admitted that there is not a bewildering demand for it yet. The need of a Clean Milk Crusade is urgent, if for no other reason than because between leaving the cow and its consumption by humanity it is often sadly injured. A rousing demand for Clean Milk by the people of England, and a willingness to pay the little extra cost entailed in its handling, would be an encouragement to the farmer and a boon to the nation.

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PIG-KEEPING.

II.

W. A. STEWART, M.A., B.Sc. (Agr.),
Northamptonshire Farm Institute.

Principles of Feeding; Constituents of Feeding Stuffs; The Albuminoid Ratio Method of Compounding Rations: Notes on Feeding Stuffs; Milk; Dry Feeding.

A KNOWLEDGE of the composition of feeding stuffs, together with some understanding of the functions in the animal body of the different food constituents, and of the needs of the animal when being fed for different purposes, is the only sound and economical foundation on which one can build up a system of feeding.

Principles of Feeding.—In addition to water, which is present in greater or less proportion in all feeding stuffs, chemical research has shown that there are in foods certain other constituents or groups of constituents which are commonly described as follows:—(1) proteins or albuminoids, (2) fats and oils, (3) carbohydrates (starch, sugar, etc.), (4) mineral matter or ash. It had been assumed that these four groups alone represented everything essential for growth, development and the production of meat and milk, but this belief has had to be modified. Albuminoids supply the constructive material for the making of muscle or lean flesh and for the repair of tissues. In milk-producing animals, the albuminoids in the food supply the raw material for the albuminoids in the milk. If albuminoids are fed in excess of the animal's requirements, the excess may be utilised for supplying heat and making fat.

The fats or oils and carbohydrates are used for making fat and for the supply of body heat and energy. For this purpose it has been computed that 1 lb. of fat is as valuable as 2 to 2½ lb. of albuminoids or carbohydrates. A moderate quantity of oil in the ration aids digestion.

Mineral Matter.—It has been usual to regard the mineral matter as of value only for bone formation, but experiments conducted at the Rowett Research Institute by Orr and Crichton* have shown that this idea is mistaken. Ten or twelve minerals are now known to be necessary to keep the animal in health. They are present as essential constituents in the blood and soft tissues where they play an important part in the chemical and physical processes which take place, and they are necessary for the normal functioning of every organ in the animal's body.

The influence of mineral matter in feeding has not received as much attention as it would appear to merit. Experiments conducted in America have illustrated in a general way the importance of minerals, but there is an absence of exact and definite information on the matter. Certain practical conclusions, however, can be drawn with regard to lime† from the Rowett Institute's experiments. It was found that for proper growth and development a pig requires a supply of lime. The quantity required varies with the age and in proportion to the rate of growth, but ⅓ oz. per day of lime (CaO) may be taken as the average requirement of a three months old pig. The effects of insufficient lime are a slowing down in the rate of growth, a softening of the bones, and in extreme cases death.

The cereal grains are poor in lime, but comparatively high in phosphates. Lucerne, clover and good grazing will supply a fair amount of lime. Fish meal and milk residues are rich in lime, phosphates, and the other essential minerals. It is quite possible, therefore, that a pig confined in a sty and fed on a mixture of cereal grains, may not receive sufficient mineral matter, and in that case, if milk is not available, some fish meal could be used to correct the deficiency.

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* *The Pig Breeders' Annual*, 1922.

† *Scottish Journal of Agriculture*, July, 1922, and *The Pig Breeders' Annual*, 1922.

McGowan and Crichton* have described a disease in young pigs, which occurred in a breeding herd where the sows were kept out in the open till within a fortnight of farrowing and then brought into sties with concrete floors, and fed on a mixture consisting of maize, brewers' grains and fish meal. The young pigs did badly and many deaths occurred. Certain characteristic symptoms were present both throughout the course of the disease and on post-mortem examination of cases. The investigators suggest that while the sows were at grass they were obtaining sufficient iron but after being brought indoors to farrow, owing to the conditions and the nature of the food the supply of iron ceased. The characteristic symptoms of the disease were attributed to iron deficiency, and large doses of ferric oxide were given to the sows in their food with good results both as a preventive and as a cure for the disease. It would appear possible that iron deficiency may be a commoner cause of malnutrition in pigs than is generally recognised.

Vitamins.—We now come to the reason for the modification of the older assumption that albuminoids, fats and oils, carbohydrates, and mineral matter supplied all that was needed to maintain the animal body in health. Experimental evidence has shown that something more than those four constituents is required. In 1912, Hopkins published the results of his experiments with rats He showed that on a ration of pure protein, sugar, lard and salts, young rats ceased to grow and ultimately died, but the addition of a very small amount of milk made a tremendous difference to their health and rate of growth. Other investigations have proved that there are certain substances which must be present in the diet of both human beings and animals, otherwise malnutrition and diseases occur. These substances have been called "vitamins" or "accessory food factors." We have at present no exact knowledge as to their form or composition as they have not yet been isolated in the laboratory, and belief in their existence rests entirely on the results of experiments, which have shown that on diets of purified food stuffs, certain diseases and symptoms occur, which either do not occur or disappear when certain substances are added to the ration. These substances are assumed to contain vitamins. From the results of further investigations, notably those conducted by Professors Drummond and Plimmer, it has been shown that there are at least three different vitamins which have been called A, B and C.

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* Leaflet of the Rowett Research Institute, Bucksburn, Aberdeen.

Absence of *Fat Soluble A* or Anti-Rachitic Vitamin results in cessation of growth and a susceptibility to infectious disease. There is some doubt as to whether rickets may be due to a deficiency of this vitamin. It is present in whole milk and in animal fats, particularly cod liver oil, and in green leaves. Cereals are low in this vitamin and such of it as may be contained in cereals is mainly confined to the germ and to the outer covering of the grain. Vegetable oils are low in it. Animals do not require much of Vitamin A to maintain health and they have the power of storing up a reserve supply. It is not readily destroyed by heat although prolonged exposure to high temperature will destroy it.

Water Soluble B or the Anti-Neuritic Vitamin is so named because of the symptoms of nervous disorder which occur when it is absent. The results of the deficiency of this vitamin were first seen in human beings in the East. Natives who live on polished rice suffer from the disease called beri-beri. Whole rice does not induce the disease and the reason would appear to be that Vitamin B is present in the outer covering of the rice grain and when the rice is polished, the vitamin is removed. In animals a deficiency of Vitamin B results in cessation of growth, in degeneration of the reproductive organs and symptoms of paralysis. Certain forms of lameness in pigs may be due to the same cause. Vitamin B is present in milk, eggs and seeds, particularly in the embryos of seeds, in leguminous plants such as clover and lucerne, and in dried yeast, cabbages, and potatoes. It is not affected by drying and not very readily destroyed by heat, though its potency would appear to be affected when it is subjected to high temperatures.

When *Vitamin C* is deficient, scurvy develops, hence this vitamin is called Anti-Scorbutic or Anti-Scurvy In animals scurvy has certain characteristic symptoms—the appetite fails, the joints become swollen and tender and the animal is reluctant to move. This vitamin is present in milk, green leaves, particularly cabbage leaves, swedes, potatoes and most vegetables. Grains contain very little, but seedlings are rich in it. Vitamin C is readily destroyed by heat and also by drying.

Very little is known about how vitamins produce their good effects, and although experiments on smaller animals such as rats and guinea pigs have certainly shown that vitamin deficiency may have very harmful results, a word of caution is necessary, otherwise undue stress may be laid on it. Vitamins have formed a popular matter of interest, and a great deal has been written about them, with the result that their practical importance to the pig feeder may have become very considerably exaggerated. One should bear in mind the wide distribution of vitamins and the fact that comparatively small quantities are necessary for the maintenance of health. It is conceivable, however, that under certain conditions the pig may suffer from lack of vitamins. The pig grows more quickly than other farm animals and vitamins are particularly necessary for rapid growth. When the pig is confined to a sty and its diet is made up largely of cereal grains and commercial by-products without the addition of green stuff, roots and milk, there may be an insufficient supply of vitamins.

Fattening pigs do not suffer so readily as breeding animals. When breeding stock are kept in confinement for long periods, symptoms of malnutrition occur, which are probably due to vitamin deficiency, but under the open air system on grass or arable land crops, pigs are likely to find all the vitamins they require. At the Rowett Institute pigs on a ration containing only small but apparently sufficient quantities of vitamins showed as great gains per day and per pound of food consumed as those to which large quantities of vitamins were given. This result is in accordance with our experience on the experimental farm at the Moulton Farm Institute.

In the light of present day knowledge about vitamins, it is prudent to feed on a mixed diet, to include home grown feeding stuffs and green food, particularly leguminous crops, like clover and lucerne, or roots such as swedes, and potatoes. As is generally known, milk is a most valuable food, and this is partly due to its containing vitamins. It should not be necessary to purchase expensive animal oil or dried yeast preparations, for inclusion in the ration, with a view to supplying vitamins. The natural sources are much more satisfactory. Crude cod liver oil is sometimes recommended, but our experience has been that when even small doses were used, and its use discontinued altogether three weeks before killing, the carcass was tainted with the smell and flavour of the oil.

Suitable Digestibility and Bulk in the Pig's Ration.—In addition to the fact that the ration should be properly balanced in the matter of albuminoids, oil and carbohydrates, and should contain mineral matter and vitamins, it must be suitable with regard to digestibility and bulk. When the food appears in the dung in much the same state as when eaten, it has passed through the pig without being digested and without benefit to the animal. The pig has a simple digestive system, and it is therefore important that the ration should be comparatively easily digested. There should not be a large proportion of coarse fibrous material. Succulent green food is readily consumed by pigs, but as far as our data on the subject goes, it would appear that pigs digest only about 40 per cent. of the green food which they consume, as against 80 to 90 per cent. of barley meal and other suitable concentrated pig foods. In spite of this, it is sound and economical practice to feed green food provided that its cost is reasonably low. It is very doubtful, however, whether it is ever economical to allow pigs to depend entirely on green food as their sole diet. It is usually found better to supplement the green stuff with a small allowance of concentrated food.

The practical issue as between the outdoor and indoor systems of pig-keeping is not merely a matter of return in live weight increase for food consumed, it is a much wider question of farming economics, necessitating a broad view. It has been repeatedly demonstrated, however, that the open air system allows of more pigs being maintained conveniently on a commercial basis and ensures a healthier and more prolific breeding stock.

Nutritive Ratio.—It has been demonstrated by experiments and proved in practice that the most economical way to feed live stock is by compounding a ration so that it contains a certain quantity of digestible albuminoids in proportion to the digestible oil and carbohydrates. The proportion necessary varies according to the age and stage of growth of the animal; according also as to whether the animal is pregnant or barren; and according to whether it is giving milk or being fattened for slaughter. This proportion is called the albuminoid ratio of the food. When the albuminoid ratio of a food is suitable for the pig's requirements, 1 lb. of live weight increase should be secured from every 3 to 3⅓ lb. of meal consumed, but if the albuminoid ratio is not correct, then 6 lb. of meal may be required to produce 1 lb. of live weight increase. The albuminoid ratio of any food is obtained by multiplying the amount of digestible fat by 2·3 (because 1 lb. of fat is approximately as effective as 2·3 lb. of carbohydrate), adding this to the percentage of digestible carbohydrates and dividing by the percentage of digestible albuminoids. Taking the average analysis of barley meal as follows:—

Digestible Albuminoids. per cent.	*Digestible Oil.* per cent.	*Digestible Carbohydrate.* per cent.
7	1.5	64
	1·5 × 2·3	= 3·45
		67·45
		67·45 ÷ 7 = 9·6

The albuminoid ratio of barley meal = 1 : 9· 6

The following is a classification* of concentrated foods used in pig feeding, with their Albuminoid Ratio:—

GROUP I.—*Foods Rich in Albuminoids, containing 30 per cent. or over.*

	Albuminoid Ratio.		Albuminoid Ratio.
Fish Meal	1 : ⅕	Decorticated Earth Nut Cake	1 : 1
Dried Yeast	1 : ½	Linseed Cake	1 : 2

GROUP II.—*Foods moderately Rich in Albuminoids, 17-30 per cent.*

	Albuminoid Ratio.		Albuminoid Ratio.
Beans and Peas	1 : 2⅔	†Dried Grains	1 : 3¾
Maize Gluten Feed	1 : 3¼	Coconut Cake	1 : 4
†Palm Kernel Cake	1 : 3½		

GROUP III.—*Foods Poor in Albuminoids (under 17 per cent.) and Rich in Carbohydrates (over 50 per cent.).*

	Albuminoid Ratio.		Albuminoid Ratio.
†Bran	1 : 4¾	Wheat	1 : 7⅓
Pollards	1 : 5	Barley	1 : 9⅓
Maize Germ Meal	1 : 7	†Rice Meal	1 : 10
†Oats	1 : 7	Maize	1 : 11

*Based on the classification in "Feeding of Dairy Cows," by J. Mackintosh.
†Foods fairly high in fibre and of only moderately good digestibility.

Feeding Standards for Different Classes of Pigs.—The approximate ratios found to be suitable for pigs are as follows:—

	Albuminoid Ratio.		Albuminoid Ratio.
Little Pigs, 3-6 weeks old ...	1 : 4 to 5	In-pig gilts and sows	... 1 : 6
Young Pigs, 6-12 weeks old	1 : 5 to 6	Sows in milk ...	... 1 : 5
Fattening Pigs	1 : 6 to 8	Stock Boars	... 1 : 5

It is not suggested that these figures are mathematically exact, but at the present stage of our knowledge of feeding they form the most useful and simple scientific check on rations which we have. For the past two years we have made up our rations for the commercial herd of pigs on the Experimental Farm on this basis, and after trying other methods of checking, such as estimating the digestible protein and starch equivalent and the total number of food units, we have abandoned those in favour of the simple albuminoid ratio check. Close observation of the results has shown the latter method to be sufficiently accurate for practical purposes. It will be clear that in making up a ration, one would look to Group I or Group II to find the requisite albuminoids. The foods at the top of Group III, *e.g.*, pollards, are well balanced. Pollards have long been known as a safe food for young or breeding stock, whereas those at the bottom of Group III are essentially fattening foods.

Notes on Feeding Stuffs. Group I.—*Fish Meal.*—It has been found that fish meal has a special value in feeding pigs. This may be due to the nature of its protein and its high content of mineral matter. Pigs apparently require some protein of animal origin and this can be supplied in the form of fish meal, meat meal or dried blood. The two latter are somewhat dangerous on account of the risk of disease. It is generally believed that 10 per cent of fish meal will supply all the mineral matter required by the pig. In order that the carcass may not be tainted with the smell and flavour of fish, it is most important that a good brand should be used and that the quantity should not exceed 10 per cent. of the ration. A good brand of fish meal should not contain more than 4 per cent. of oil or 3 per cent. of salt and should be guaranteed as made from sound white fish only. An additional safeguard against tainting can be secured by discontinuing its use during the last fortnight or three weeks of fattening.

Dried Yeast.—In addition to being rich in albuminoids, dried yeast contains the Vitamin B. In use it has the rather serious drawback that it sets up fermentation when mixed with anything of a sugary nature.

Decorticated Earth Nut Cake should only be used in small quantity and for adult pigs, as it is apt to cause scouring.

Linseed Cake.—At the rate of about 10 per cent. in the ration, linseed cake is a most valuable food for maintaining health and producing " bloom " of coat and skin. If very rich in oil and fed in fairly high quantities to sows in milk it is liable to cause the little pigs to scour. Used in excess of 10 per cent. to fattening pigs it may produce a soft yellowish fat.

Group II.—*Beans and Peas* are the two home-grown foods richest in albuminoids. Both have a somewhat binding effect and should not exceed a quarter of the ration.

Maize Gluten Feed is a by-product from maize. It is a good pig food without any apparent bad effect on the pork or bacon.

Palm Kernel Cake is now fairly extensively used. It is usually cheap but it is not a high class feeding stuff and is rather unpalatable and not very highly digestible. It should not be fed to young pigs. and should never exceed 20 per cent. of the ration. Palm kernel meal (extracted) is an inferior food.

Dried Grains in small quantity not exceeding 10 per cent. help to stimulate milk production in sows. As a food, however, they are rather fibrous and of low digestibility.

Coconut Cake is fairly similar to palm kernel cake. It will soak up very large quantities of water. It is quite a useful feeding stuff if not used in too high proportion in the ration.

Bran contains a good deal of fibre and on that account should be limited to 10 per cent. of the ration. It has a mild medicinal action and when fed wet acts as a laxative. It is good for sows just before and after farrowing as it prevents constipation and stimulates milk production.

Pollards are too well known to require comment. They form the safest pig food that we have.

Maize Germ Meal should consist of the germ of the maize grain. It has a high oil content and is therefore slightly laxative. If used in excess the oil may have a harmful effect on the carcass.

Oats contain so much husk that they are not specially suitable for pig feeding. If the husk can be got rid of, the oat meal forms a wholesome feeding stuff.

Wheat is best used in small proportion mixed with other feeding stuffs. If used too liberally it makes the ration pasty and sticky, causing indigestion.

Barley is the staple fattening food. It is highly digestible.

Rice Meal is high in oil and fibre. If used in quantity it produces rather an inferior type of carcass. It is low in mineral matter and this possibly explains the common belief that rice meal causes lameness.

Maize is very starchy and forms a fattening food. If used in excess it produces a type of carcass which is strongly objected to by bacon curers. The lean of such a carcass is not of good quality and the fat is soft and oily.

Milk.—Whole milk is a nearly perfect food and is almost entirely digestible. Separated milk, which is more commonly used in pig feeding, is invaluable for young pigs and sows in milk. As most of the fat has been removed it has a slightly binding tendency. Some of the Fat Soluble A vitamin has been removed but the other vitamins are still present along with the mineral matter. One gallon of separated milk is roughly equivalent to 1 lb. of digestible mixed meal.

Whey is milk from which the greater part of the fat and proteins have been removed. 1½ gallons of whey would be roughly equivalent to 1 gallon of separated milk or 1 lb. of digestible mixed meal.

Dry Feeding.—Dry Feeding has been under trial and investigation on the Northamptonshire Experimental Farm, Moulton, since July, 1922, and the results obtained here and elsewhere would appear to indicate that dry feeding is likely to play an important part in the economics of pig-keeping in the future. The established system of feeding wet food, in a more or less liquid condition, entails much labour where pigs are kept on a commercial scale. Unless the pig attendant is thoroughly skilled and highly intelligent, the quantity of water in the food is not varied as it should be according to the pig's requirements, especially as affected by weather and atmospheric temperature, with the result that in cold weather pigs are frequently forced to consume more water than they either need or want, while in warmer weather they may not receive enough. With dry feeding and the provision of a constant water supply in the pen or run, this most important matter is controlled by the pig itself. The pig drinks just what it requires, and this is a most vital point in feeding both in the matter of health and development.

Digestive troubles and colds, which frequently occur in winter and develop readily into pneumonia or other lung affections, can often be traced to giving too much water under the wet feeding method, and the chill to the system which this entails. Our experience and observations confirm the opinion that such disorders are less common with dry feeding. With an efficient type of feeder, the food is always quite sweet, and for young pigs in particular this is a very important detail. Sour food is one of the commonest causes of illness. Pigs when dry fed, masticate their food. Mastication is the first process in efficient digestion. Efficient digestion and absorption should mean that less food is required to produce 1 lb. of live weight increase

The practice of dry feeding goes best with the open-air system of pig-keeping. It can, however, be practised in yards or pens, but it is important that dry fed pigs should have adequate facilities for exercise.

It has generally been found advisable to allow an unlimited ration to fattening pigs, and to young pigs up to the age of about 16 weeks. When this is done the feeder can be filled up to its capacity and the pigs allowed to help themselves. It is therefore unnecessary to provide feeding accommodation so that all the pigs concerned can feed at one time. A feeder which will accommodate say 12 pigs at a time will be sufficient for a bunch of three or four times this number, and even the smallest and most weakly pigs will have ample opportunity of feeding, as all the pigs will not want to feed at once. For breeding stock the limited ration is the most satisfactory method. When limited to a few pounds a day, it is necessary to put the whole ration in the feeder once daily, or to halve it—putting half in in the morning and half in the afternoon. When limited rations are used, sufficient feeding space for all the pigs to feed at one time will be required. Even where the food is given in two portions daily there is saving of labour compared with the wet method of feeding.

In-pig sows up to three weeks before farrowing have done extremely well on 2 to 3 lb. of dry meal per day in winter and less in summer, together with green stuff, roots or potatoes. When potatoes are fed in quantity it is necessary that the meal should be specially rich in albuminoids. On a modified open-air system, for stores and breeding stock, including sows up to shortly before farrowing, dry feeding is satisfactory and economical.

In the case of fattening pigs, there is considerable difference of opinion. Such experiments as have been carried out are hardly conclusive. It is essential that the pigs should not be allowed to become costive. To prevent this they must receive either green food or roots, or the ration itself must be sufficiently laxative. This has been secured here by the inclusion of a small percentage of crushed linseed or linseed cake.

In practice, when preparing pigs to be sold as medium pork (100-120 lb. dead weight) and for bacon (140-170 lb. dead weight), it has been found satisfactory to run the pigs on arable land crops on dry food, and then to have them in yards at the farm buildings for the last three or four weeks before disposing of them, and to feed them on wet food. It is a convenient time to discontinue the use of fish meal when the pigs are put on the wet food. This ensures that there is no possibility of the carcass being tainted.

Dry Feeders.—A dry feeder should have the following qualifications:—(1) It should protect the food from wind and rain and from birds and vermin; (2) it should be possible to regulate the supply of food so that it will run slowly from the hopper and not accumulate in the trough; (3) it should be easily movable; (4) it should be as simple as possible in construction; (5) it should be durable and not easily broken or damaged, moved or upset by pigs. After extensive trials with the principal makes, we have not yet found a perfect dry feeder.

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THE CULTIVATION OF SUGAR BEET.

ALFRED WOOD, F.C.A.,
Secretary of the British Sugar Beet Growers' Society and Secretary and Assistant Secretary, respectively, of the Kelham and Cantley Beet Sugar Factories.

Nature of the Crop.—The sugar beet is a root plant of the same family as the mangold. Properly cultivated it is a long tapering root, of a shape and colour similar to a parsnip, but larger and broader at the top (Fig. 1). Its weight, excluding the crown and leaves, averages from 1½ to 2 lb. If through shallow cultivation it develops fangy roots it loses in sugar content. It has a heavy green foliage. Unlike the mangold it grows almost entirely below the surface. The beet develops innumerable rootlets and root hairs, absorbing water and plant-food to feed the plant, which permeate and ventilate a wide radius of soil (Fig. 2). These are detached in the act of lifting the beet.

Sugar Content.—Formerly the sugar beetroot (or white mangold) only contained 6 per cent. of sugar, but after selection of seed over many years the plant now produces and stores in the root from 15 to 20 per cent. of its net weight of sugar. All commercial seed used in sugar beet cultivation for the production of sugar is grown from "mother seed," which is carefully propagated from year to year at seed producing stations under the control of scientists trained in this special branch of the work. If seed were grown the second year from the commercial sugar beet the plant would be inclined to "throw back," and the beets grown therefrom would be of no value for sugar production. The sucrose or sugar in the beet is the product of air, light and water. It is produced in the leaves and stored in the root. When the leaves have done their work they become greenish yellow and wilt. The top or crown of the root (from below the lowest leaf or bud) is removed on the field (Fig. 1) as it contains the smallest percentage of sugar and the greatest amount of impurity. It is therefore useless for sugar extraction, and is in fact harmful to the manufacturing processes.

Climate.—It has been proved that the climate of England is eminently suitable for the crop. This was amply shown in the bulk cultivation of beet which took place during the exceptionally sunny but dry season of 1921, and the correspondingly wet and sunless season of 1922. In both these years the sugar content in the beet averaged over 16 per cent. The Eastern Counties of England most resemble the chief beet-growing districts of the Continent, but satisfactory crops of beet have been grown in most parts of this country south of the Humber, and there is no reason to suppose that the crop might not be successfully grown still farther north.

Soil.—The best soils are deep loams, well supplied with lime and organic matter. Any free-working soil, however, adapted for growing roots, barley or potatoes should grow beets well. Even with strong clays the beet can be made to thrive with liberal treatment of the soil, the main objection being the increased labour in lifting a deep root, although a high sugar content is usually obtained. Very shallow soils should not be used. Instead of a long tapering root, the beet takes a mangold shape and develops fangy roots. Deformed roots are also caused by insufficiently drained soil

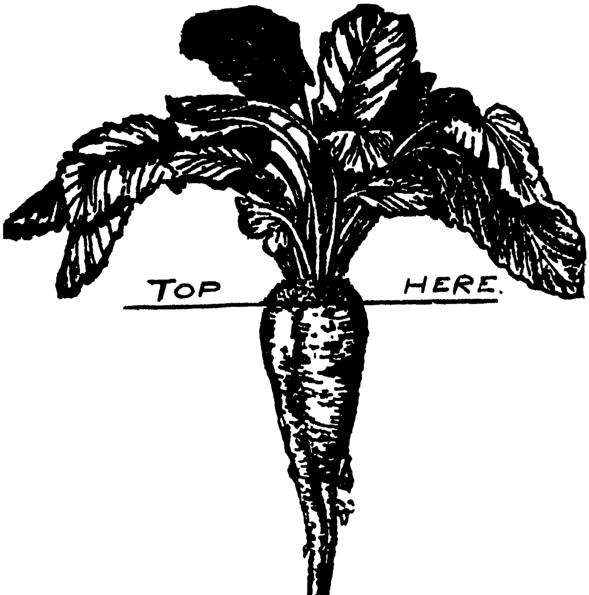

FIG. 1.—A typical Sugar Beet, showing correct Method of Topping.

Rotation.—Sugar beet can be grown several years in succession on the same land, but this is not recommended. Each year the crop becomes lighter and is more liable to attack by pests, especially if the tops and leaves have been ploughed in. It is more economical to grow the beet crop as the cleaning crop in the rotation, replacing mangolds, swedes or common turnips, to be followed by wheat, oats or barley and seeds. It is sometimes taken after a root crop, after a clover ley broken up early, or after peas or beans. There is no hard or fast rule for the place of sugar beet in the rotation. The farmer will decide, as with his other crops, according to the specific conditions of his own farm.

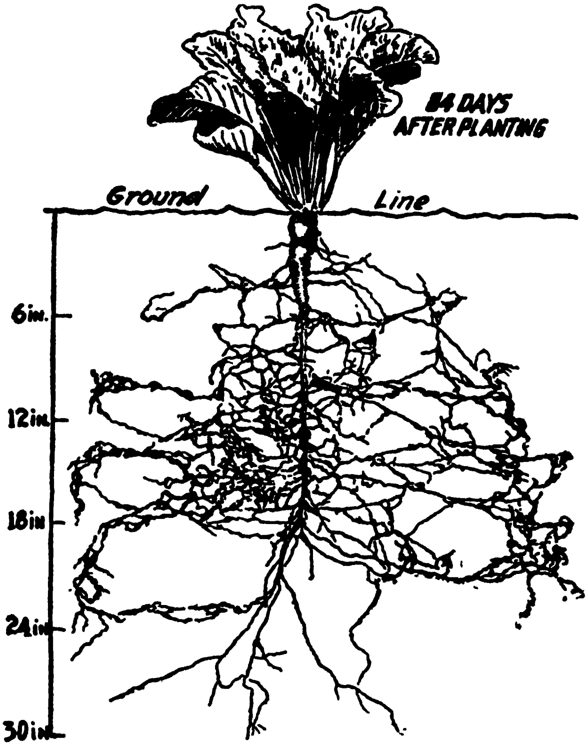

FIG. 2.—The Sugar Beet's Action on the Soil during growth.

Cultivation.—The cultivation of the beet crop is similar to that required for mangolds. *Deep working is essential* in the case of sugar beet. Preparation should take place as soon after harvest as possible. As soon as the cereal crop is clear of the field, weed and other seeds begin to grow, and their growth can be encouraged by light cultivation, not more than 3 in. deep, by skim plough or cultivator. After fourteen days to three weeks the land should be thoroughly cleaned of surface rubbish. Farmyard manure (10 to 12 tons per acre) is then carted on and ploughed in deeply to a depth of 10 in. or more and the land then left to be pulverised by the winter frosts. This would avoid spring ploughing, as a friable soil will be secured which should be well worked in April in time for sowing. The roots must be given every opportunity of going deep. The under soil must therefore be thoroughly pulverised, while the upper soil should be more compact so as to give a downward direction to growth.

Manuring.—Practically all the manure in the rotation is applied to the sugar beet crop, *the succeeding crops requiring no manurial assistance.* The beet crop will not exhaust the soil and the manuring together with the thorough cultivation improves and cleans the land for the succeeding crops.

The sugar beet uses relatively large quantities of potash, but not so much nitrogen or phosphoric acid. Nitrogen stimulates the leaf growth. Potash is closely associated with the formation of sugar in the leaves. Phosphates are required less for the production of beets than for the formation of seed, which is not required in beet cultivation for sugar production. Beets which run to seed in the root year are starved in sugar content, and are useless for sugar manufacture. They should be taken out as they appear. They should never reach the factory as they are injurious to the working of good roots.

In general the manurial treatment required for a successful beet yield is that usually applied to secure a good potato crop. This will vary in different localities according to the nature and condition of the land, and the manuring of preceding crops. The experienced grower will manure his land according to his intimate knowledge of his own farm, making comparative tests to secure the best results, and no two growers will be found to act exactly alike in this respect. The following examples are therefore given with reserve, merely as an approximate guide to the new grower as to the relative values of the different manures on all soils, the quantities, in actual practice, being increased or reduced according to the condition of the land and the variations of the soil :—

	1. Heavy Soils	*2. Medium Soils*	*3. Light Soils*
Farmyard Manure	10 to 12 tons	10 to 12 tons	10 to 12 tons
Lime	1 cwt.	2 cwt.	2–3 cwt.
Phosphates (30 % to 35 %) ...	6 cwt.	4 cwt.	2 cwt.
Potassium Salts (20 %) ...	1 cwt.	3 cwt	5 cwt.
Sulphate of Ammonia ...	1 cwt.	1 cwt.	1 cwt.
Nitrate of Soda	1½ cwt.	1½ cwt.	1½ cwt.

The farmyard manure and lime should be applied in the autumn, the phosphates (unless in the form of basic slag) and the potash in the spring. The sulphate of ammonia should be harrowed in when preparing the seed bed, and the nitrate of soda should be used as a surface dressing in two parts, half after the first hoeing and the rest after the singling has been completed.

Drilling.—Seed is always supplied by the factory at cost price, and only beets grown from this seed are accepted. It is not possible to lay down a fixed date for drilling, as weather conditions vary from year to year. As the factories require some of the beet of each grower early in October, it is advisable for a grower to drill part of his acreage not later than the middle of April, but it is wise not to sow earlier. If sown earlier the early mild weather encourages growth, and if the later colder weather brings growth to a standstill for a time, the roots may then develop a tendency to run to seed. Early drilling will always enable a grower to re-drill if a satisfactory plant is not obtained at the first drilling. Where a large area is grown by a farmer, he should drill at three different times at intervals of 10 to 14 days. The beets will not then require singling or hoeing at the same time, and as they also do not ripen at the same time the average sugar content at delivery is kept higher because the factory requires deliveries for manufacturing in equal quantities during the season from 1st October to 20th December. *A good seed bed is essential.* A faulty seed bed is often the cause of patchy fields of plants. Drilling in a well-prepared seed bed gives the most successful results if the drilled rows are slightly pressed down by small rollers fixed behind the coulters. This has the advantage also of indicating the drilled rows, and a first hoeing can be done if found necessary even before the plants appear. The seed should be drilled on the flat in rows from 16 to 18 in. apart, preferably 16 in., and not more than 1 in. deep. Not less than 15 lb. of seed per acre should be drilled; abroad as much as 25 to 30 lb. are drilled. It pays to be generous with seed. This reduces the risk of poor germination and of plants being attacked by pests. It gives greater scope for securing a good " stand," that is to say, the number of good plants per acre, and thus avoids a " thin " crop. If the plant is not coming up evenly the germination can usually be assisted by rolling, preferably across the rows. If the rolling is done early in the morning it helps to keep down pests.

Hoeing.—Success in sugar beet cultivation depends very largely on the singling (thinning) and hoeing of the sugar beet crop. The object is to cause all the efforts of growth to be concentrated upon the best plants which are being isolated to create the sugar. Horse-hoeing should be done early, thoroughly and continuously until such time as it is no longer possible, owing to the rows being covered by the leaves of the plants. It should be commenced as soon as the plants in the row reveal themselves. Light draught horse hoes as used in America and Denmark are recommended. They are fitted with protecting disc coulters for the first early hoeing, replaceable by duck foot and angle tines as required. They are capable of hoeing four rows at a time, and the tines can be adjusted by the driver to allow for any irregularity in the rows. As the leaves are the sugar-producing agent care should be taken not to damage them. In hoeing, the roots, unlike mangolds. should be kept covered by soil. Uncovered roots lose sugar content. Hoeing must be maintained not only by the horse hoe between the rows, but by the hand hoe between the plants in the row. The beet crop compels the constant cleaning of the land from the moment drilling is started until the harvest begins. It necessitates special attention to the loosening of the soil between the plants. This allows light and air to penetrate the soil to the benefit of succeeding crops. Foreign experience has proved the value of this.

Singling.—When the plants show *four leaves* they should be carefully singled. Singling consists of two operations. First, bunches of plants in the row are isolated by chopping out with a hand hoe all intermediate plants between each bunch so that the bunches are 12 to 14 in. apart. The chopping-out should be at least 1½ in. deep to clear away any seed not yet germinated, and the block should not be more than 1 in. wide. On the black fen lands, where beets are inclined to grow big and coarse, a higher sugar content will probably be obtained if the plants are singled 8 in. apart. The actual singling takes place by loosening the soil in the bunch so that the plants fall apart, holding down the best plant it is intended to leave and removing all other plants and weeds in the bunch. Singling is usually paid for at piece-work rates. An experiment conducted in Germany showed the following results:—

Time of Singling	*Yield in Tons*
At the proper time	15 tons.
One week later	13.5 „
Two weeks later	10 „
Three weeks later	7 „

It is therefore clear that the yield per acre and the percentage of sugar content depend very largely upon early and proper singling.

Moisture.—A good root, that is to say, a long single root without fangs, produces the highest sugar content, because its storage qualities are the greatest. In addition, it more readily withstands drought, as it reaches down more deeply for moisture than the shorter or deformed roots.

Pests.—The sugar beet plant has been found to be less subject to attack by the mangold fly and other pests than the mangold plant.

Harvesting.—Ripeness is indicated by drooping of the leaves and their changing to a yellowish-green colour. About three-quarters of the foliage should have wilted, but the central leaves should still be fresh and green. Lifting is done by two operations. A beet lifter (Fig. 3) is used to loosen the beets from the soil surrounding them. They are then pulled out by hand, two at a time, knocked together to remove as much soil as possible, and laid in rows or thrown into heaps.

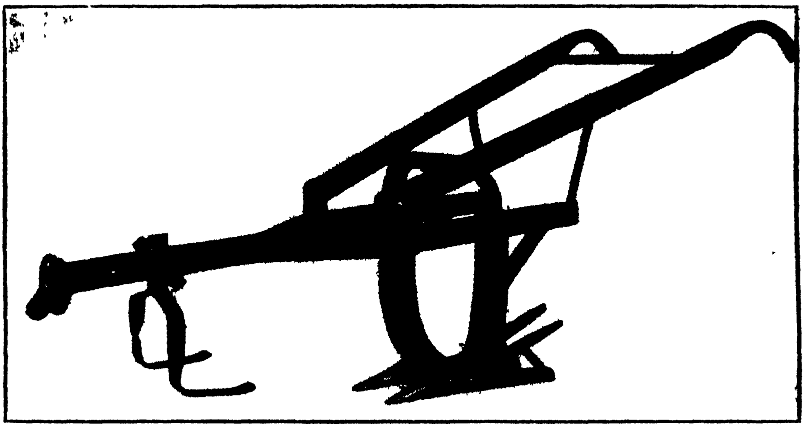

FIG. 3.—A Sugar Beet Lifter, adjustable for large or small beets.

Topping (Fig. 1) is best done by one blow of a heavy knife. Unless carting is done promptly the heaps should be covered with the tops and leaves to avoid reduction of sugar content through frost or the action of the sun. When there is danger of frost they should be clamped like mangolds. Beets do not suffer from the frost before lifting. They should be thrown into the carts with beet forks (Fig. 4) having prongs with small globular ends which do not pierce the beets.

Tops and Leaves.—The tops and leaves should be left on the field. They are equal in weight to 75 per cent of the root when topped. If ploughed in they are of considerable manurial value, but may assist in giving new life to parasites, animal and vegetable, which live on beets, if a beet crop follows on the same land. In foreign countries they are considered of greater value if used for feeding direct off the land for cattle, sheep or pigs. It is customary abroad in the autumn to take the tops and leaves to the fields where cattle are still grazing, as they cause a heavy milk flow. They are also ensiled to serve as a winter food. They should never be fed wet or dirty, and should be used carefully as they have a somewhat laxative effect.

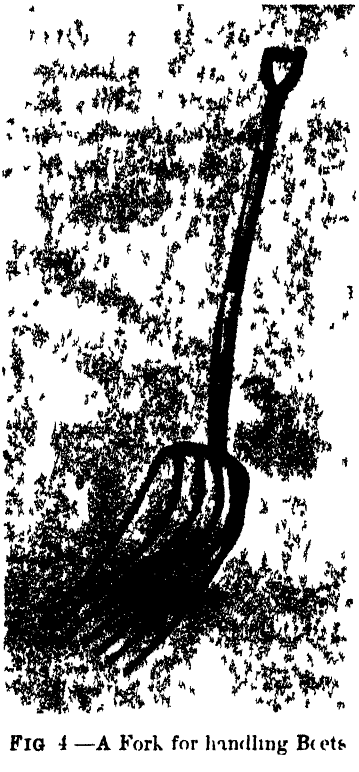

FIG 4—A Fork for handling Beets

Yield.—The yield varies according to the land on which the beets are grown as well as the care taken in preparing the land and in the after-cultivation. A fair average crop is 8 to 12 tons of washed and topped roots Some districts, such as the Fen country, can produce crops up to 14 or 18 tons. The lighter crops often give a comparatively greater percentage of sugar content.

Sugar Beet as a Cattle Food.—The sugar beet is used mainly for conversion into sugar and is most profitably disposed of to a factory, but it can also be used as a food for stock. *In cases where a trial crop is grown which cannot be sent to a beet sugar factory*, the crop may be fed as follows :—4 lb. of sugar beet (as topped) may be substituted for 8 lb. of mangolds or 1 lb. of cereal meals in a mixed ration. 20 to 30 lb. may be fed daily to dairy cows, as much as 50 lb. to fatting cattle, 10 lb. upwards to young cattle, and 10 lb. downwards to calves. For pigs, 1 lb. of barley can be replaced by from 4 lb. to 8 lb. of sugar beet in a mixed ration. The use of the whole sugar beetroot as a food for stock has no special value as compared with mangolds, though they are particularly suitable for pig feeding. On the other hand, the value of the tops and leaves and of the dried sugar beet pulp from the factory for this purpose cannot be over estimated.

Delivery to the Factory.—The price paid by the factory is a delivered price per ton of washed and topped beets and varies according to the sugar content in the root, as ascertained by the factory chemist. A calculation is made of the percentage of tare delivered by the grower in a fair sample which is washed and re-topped (if necessary). It is therefore to the grower's interest (*a*) to top correctly, and (*b*) to send the roots as free from dirt as possible, as he will be paying carriage upon weight for which he does not receive payment. The roots are washed at the factory and not by the grower. As the sugar content is ascertained from a sample of the roots in the form in which they enter the factory, and as the top contains a negligible amount of sugar, if the grower does not top properly, he will also reduce the proportion the sugar content bears to the weight of the whole root. This is important to him in its effect upon his price. If his yield is low through inattention to the points set out above, he will reduce his profit per acre, as he is paid according to the actual net tonnage delivered. He should also fully load the railway trucks, as the carriage rate for beet is fixed upon a minimum load of six tons. Otherwise he will again lose through excessive carriage charges.

By-Products.—The grower is always allowed, under the beet contract, to purchase back from the factory up to 5 per cent. of the net weight of beet delivered in dried beet pulp at the special price stated in the contract. This product is the main by-product of the factory and is a valuable food for stock, increasing the yield of fattening cattle and the milk flow of dairy cows. He is thus enabled to return to his land what the sugar beet crop has taken from it, and the dried pulp acts as a substitute for the mangolds or swedes he would otherwise have grown for consumption on his own farm. This completes the agricultural circle, as it were, so that he has only taken from his land the sugar which has not drawn upon its fertility. On the contrary, the land has been made more productive for the crops following in the rotation. In foreign countries it has been proved that sugar beet increases the yield of the corn crops that follow by 10 to 15 per cent., and farmers are now beginning to testify to similar results in this country.

The Growers' Return.—In 1922 the factory offered 32s. per ton of washed and topped roots put on rail. In addition, 2s. was added or deducted proportionately for each 1 per cent. of sugar content above or below 15½ per cent. The average sugar content over the whole crop was slightly over 16½ per cent., so that the average return to the farmer was 34s. per ton on rail. Though costs of growing varied in different districts and according to the experience of the grower or his labour, it was acknowledged generally by the growers that their beet crop yielded a very satisfactory profit. For 1923 the price is 40s. per ton of beet delivered at the factory. There is again a variation in price if the sugar content is above or below 15½ per cent., 2s. 6d. being added or deducted proportionately for each 1 per cent. above or below that basis. There is, however, in 1923 a further variation according to the average sale price of sugar realised by the factory; 1s. per ton of beet is added or deducted proportionately for each 1s. or fraction thereof in the price of sugar above or below 40s. per cwt. The price of sugar at present is 54s. 6d. per cwt., so that if this be the realised price and the grower secures an average sugar content similar to that of last year, viz., 16½ per cent., he would receive a return of 57s. per ton of washed and topped roots delivered at the factory. Allowing for a probable fall of 5s. per cwt. in the price of sugar, he would still receive 52s. as a delivered price, and as the average carriage, having regard to recent reductions in the rates, will probably be 5s. per ton, he would then receive 47s. per ton on rail for his beets instead of 34s. last year. Further reductions often accrue through delivering to the factory direct by cart or lorry, thus saving railway freight and one handling.

Cost of Production.—With regard to the cost of production, detailed costs are often misleading and can never be ascertained with accuracy for purposes of average, yet it is generally found that the total cost, whatever the variation in specific items may be, approximates the same figure. From inquiries as to experience to date, the British Sugar Beet Growers' Society came to the conclusion that £15 might be considered as a fair average cost under present conditions of growing an acre of beet and putting the produce on rail. In some cases, however, the cost has not exceeded £12. It was also found that as the greater portion of the cost of a crop of beet consists of labour, considerable economies are possible as the grower becomes more experienced. Taking specific districts, however, such as the Spalding area, the cost per acre might reach £20, but the grower, as a rule, secured a much greater yield, which has more than compensated for this additional cost. The Society also found that the average yield under normal conditions might be taken at 10 tons per acre, although on account of certain special circumstances there was a lower average yield last year, and although in the previous year, in the areas serving the Kelham factory, the average yield was higher. An acre yielding 10 tons of beet might therefore be considered to cost not more than £15, and might cost not more than £12. This gives the cost per ton of beet at 24s. to 30s. per ton on rail, and with a greater yield a lower cost still. For this reason it is desired to emphasise the importance of the notes on hoeing and singling. Each ton of yield lost through unsatisfactory cultivation seriously reduces the growers' profit.

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DATES OF BLOSSOMING OF APPLES AND PEARS.

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THE growing of apple trees in this country has occupied the attention of many people for hundreds of years, but few have been sufficiently interested to carry out annual observations and record systematically the behavior of the different varieties. Possibly trees are not favoured for observation work for the reason that results can be obtained but slowly and hold out little promise of completion in any one lifetime. The choice of such a plant would only be made by one possessed of great patience, and with little desire to push matters with great speed. All workers on pomology are aware of this and will appreciate the work which has been done by Mr. James

Udale, the experienced horticulturist of Worcestershire, whose observations on fruit trees have been made over a period of 20 years, and the work of Mr. Cecil H. Hooper, who has worked out statistics and averages to utilise Mr. Udale's records of the blossoming and fruiting of many varieties of apples, pears and plums. The chances afforded to Mr. Udale do not come to all. He established, in 1896, an experimental fruit plantation at Droitwich for the Worcestershire County Council, and was thus able to start his work early in the life of a new plantation and to continue to record the behaviour of these trees as they grew and came into bearing. The records commenced in 1896 and were completed in 1920. For the purpose of Tables I and II the figures for the first four years have been omitted.

Particular attention was given each year to the dates of flowering of different varieties and to the yield of each individual tree. The figures for yield can be of less use or importance for permanent records chiefly because of the varying factors in each locality which influence the crop. Some factors vary with every plantation and constitute a great uncertainty in the problem. Nevertheless the crop records are not without their interest and use, if their limitations are accepted and properly understood. The records of the date of blossoming are of more value, though even in this case there is a little uncertainty as to the influence of the stock on the date of flowering, and it is feared that information is lacking as to the type of stock used in the Droitwich gardens.

Apples.—There is a tendency for growers, at the present time, to limit the number of varieties of fruit to a few commercial kinds, which for trade reasons is both desirable and necessary, but as this may lead to the planting of large blocks of varieties the flowers of which are self-sterile, or are self-fertile to only a small degree, it becomes necessary for the planter to have accurate knowledge both as to the degree of self-fruitfulness and as to the period the variety is in blossom. With the self-sterile and partially self-sterile varieties such as Beauty of Bath, Cox's Orange Pippin and Grenadier, it becomes necessary to plant varieties which can serve as "mates" or pollenizers, and an important matter of this kind should not be left to chance. The pollenizer can only be of use if its pollen is ready when the flowers of the self-sterile variety are ready to receive it, and thus it is necessary to plant varieties with a common flowering period, or, at any rate, varieties with flowering periods which overlap considerably. Mr. Udale found with apples that the longest period between the blossoming of the earliest and the latest varieties was 31 days, which is a very considerable range, but that the average range was about 16 days.

The records from Mr. Udale's observations are shown in Tables I and II, from which the order of flowering of the varieties can be seen. Based on these records and those obtained by observers in other parts of the country, the order of flowering is placed as follows:—*

Earliest - Irish Peach (F1), Warner's King (F2), Bismarck (F3).
Early - - Beauty of Bath (S), Stirling Castle (F1).
Mid-Season James Grieve (F3), Gladstone (F3), Allington (F2), Rival (F2), Cox's Orange (S), Early Victoria (F1), Bramley (F3). Lord Grosvenor (F1), Ecklinville (F2), Worcester Pearmain (F3), Grenadier (S or F3).
Late - - Lord Derby (F1), Lane's Prince Albert (F3), Newton Wonder (F3), Annie Elizabeth (F3). Lady Sudeley (S or F3), Blenheim Orange (S).
Very Late - Royal Jubilee (S).

Mr. Udale's and Mr. Hooper's records will also be of use in assisting growers situated in exposed places or in places subject to late frosts, to select varieties which come into blossom at less dangerous periods. The varieties of apples that ripen first do not necessarily blossom first, for Mr. Udale found that the very late dessert apple. Sturmer Pippin, flowers early

TABLE I.

Average Order of Blossoming and Yield of Apples at the Worcestershire Experiment Garden, Droitwich, 1900 to 1920.

Variety.		*Yield in 21 years. lb.*	*Average yield per tree per year in lb.*
Bismarck	bush	1,340½	64
Stirling Castle	bush	1,481	70
Sturmer Pippin	bush (2 trees)	1,590½	38
Lord Grosvenor	bush (3 trees)	5,154½	82
Ecklinville Seedling	bush (3 trees)	3,802	60
Mr. Gladstone	bush	305	14
Worcester Pearmain	bush. unpruned	1,715	81
Cox's Orange Pippin	bush	466½	22
Bramley's Seedling	standard	3,176	151
Lane's Prince Albert	bush	3,557½	169

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* The letters after the names of the apples and pears signify that the variety is (S) self-sterile, (F1) partially self-fertile, (F2) occasionally self-fertile, (F3) very rarely self fertile.

whereas Gladstone, one of the earliest dessert varieties flowers fully a week later. The exact date at which the trees burst into blossom largely depends on the weather of the year. Generally, the end of April to the middle of May would be the average for the Midlands, but Mr. Udale found in 1914 that the period during which the earliest and latest apples began to blossom was 17th April to 29th April, and in 1920, 11th April to 2nd May. In other years it was later. The order of blossoming of the different varieties is perhaps the only satisfactory way of collating these records.

Pears.—With pears the interval between the date of blossoming of the earliest and latest blossoming varieties, as recorded by Mr. Udale in Worcestershire, was from 9 to 35 days, with an average of 12 days difference, whilst in Kent, Mr. Hooper found the range to be 13 days in 1908 and 18 days in 1909. Jargonelle and Beurré d'Amanlis were the first to flower and Doyenne du Comice amongst the last, so that the chances of either of the former pollinating the self-sterile Comice would be small in normal years. Winter Nellis, Clapp's Favourite, or Marie Louise, which flower only slightly in advance, should provide suitable pollen for Comice.

TABLE II.

Average Order of Blossoming and Yield of Pears at the Worcestershire Experiment Garden, Droitwich, 1900 to 1920.

Variety.		*Yield in 21 years. lb.*	*Average Yield per tree per year in lb.*
Beurré d'Amanlis	standard	1,893	90
Maréchal de Cour	bush	447¼	21
Louise Bonne of Jersey A	bush	523	25
Louise Bonne of Jersey B	bush	750	36
Durondeau	bush	934	44
Beurré Superfin	bush	467	22
Marie Louise d'Uccle	bush	1,882½	90
Beurré Hardy	bush	1,256	60
Williams' Bon Chrêtien	standard	1,189	56
Fertility	bush	4,706	229
Pitmaston Duchess A	bush	723¾	34
Pitmaston Duchess B	bush	1,379	66
Clapp's Favourite	bush	1,161½	55
Winter Nellis	bush	219¾	10
Marie Louise	bush	758¾	36
Doyenne du Comice A	bush	1,140½	54
Doyenne du Comice B	bush	996	47

The records of Mr. Udale are set out in Table II. Mr. Hooper, from these and other observations made in the south, places the varieties in the order of flowering as :—

Earliest -	Jargonelle, Doyenne d'Eté.
Early - -	Beurré d'Amanlis (S), Conference (F2), Marguerite Marillat (F2), Beurré Clairgeau (S), Duroudeau (F3).
Mid-Season	Louise Bonne of Jersey (S), Emile d'Heyst (S), Clapp's Favourite (S), Marie Louise d'Uccle (S), Fertility (S). Catillac (S).
Late - -	Hessle (F3), Beurré Capiaumont (S), Dr. Jules Guyot (F3), Doyenne du Comice (S).

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THE AGRICULTURAL CREDITS ACT, 1923.

THE PROVISION OF SHORT-TERM LOANS.

Objects.—Under Section 2 of the Agricultural Credits Act, 1923, new facilities have been placed in the hands of farmers, small holders, allotment holders, and other agriculturists, for obtaining short-term loans.

The object of this part of the Act, is the provision of machinery easily accessible to agriculturists, under which they can obtain credit to meet such expenses as the purchase of seeds, fertilisers, feeding stuffs, the purchase of breeding and other live stock, of machinery and implements, the erection of silos, barns, fencing, etc., the purchase of fruit trees, etc.

Outline of the Scheme.—This will be done by establishing Agricultural Credit Societies which will be empowered, subject to certain conditions, to make loans to farmers, small holders or allotment holders, repayable within periods not exceeding five years, and which will also be entitled to assistance, in the shape of money advances from the State.

The first point to be realised by those who wish to avail themselves of the credit facilities provided by this part of the Act, is that these facilities are limited to the provision of loans made by Agricultural Credit Societies *to their members*. The formation of such a society is, therefore, a necessary precedent to the making of any loans, and it is the first step to be taken in putting the scheme into operation.

The distinctive features of an Agricultural Credit Society—such as is contemplated in the Act, are :—

1. It rests on the fundamental principle of the mutual responsibility of its members.

2. It is local—its members living within a comparatively small area and being known to each other.
3. The liability of each member is limited to the full value of the shares in the society held by him.
4. It may, subject to certain conditions, borrow money from the State for the purpose of making loans to its members, and may also, with the consent of the Minister of Agriculture, borrow from other sources.

The Act provides that the share-capital of a society shall consist of an unlimited number of shares of £1 each, held by members of the society, upon each of which a sum of 5s. has been paid up, and that the Minister may, subject to certain regulations, make advances to a credit society, provided that the total sum advanced to a society shall not exceed an amount equal to £1 for every £1 share held by the members upon which 5s. has been paid up. The paid-up share capital, plus this Government advance and any other sums borrowed with the consent of the Minister, may be said to form the total loanable funds out of which the society may make loans to its members. It is clear, therefore, that an essential condition for the establishment of such a society on a satisfactory basis, is that the number of members, and the number of shares held by them, should be sufficient to provide the society with adequate funds in order to make it possible for it to carry on its operations successfully.

The Formation of a Society.—When in any agricultural district there is a wish to form a credit society under the Agricultural Credits Act, the first step to be taken is for the promoters of the society to obtain from local agriculturists or others a sufficient number of promises to take up shares in the society to justify them in taking any further action.

In doing so it should be borne in mind that although these societies are intended solely for the assistance of persons engaged in agriculture, membership is open to any person sufficiently interested in promoting the prosperity of local agriculture to be willing to lend his capital and his credit for that purpose. In this matter the founders will have to exercise their own judgment, although the advice of officers of the Ministry will be placed at their disposal. It is obvious, however, that the larger the society, the more useful it will be, while it is hardly necessary to point out that the difficulties of initiating and carrying on a society with a very small share capital will be very great indeed, if not prohibitive.

The next step in the formation of a society will be to obtain a copy of the Model Rules which have been prepared for adoption by such societies and will be obtainable from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. These rules set out in detail the constitution of such a society, its method of operation, and the manner in which it must be conducted in order to conform with the provisions of the Agricultural Credits Act, 1923, and the Industrial and Provident Societies Acts, 1893-1913, under the latter of which Acts, an Agricultural Credit Society must be registered.

Steps must now be taken to register the society, and for this purpose a letter should be addressed to the Chief Registrar of Friendly Societies, 17, North Audley Street, W.1, asking for the necessary forms of application for registration. These application forms must be filled up in accordance with the instructions which accompany them, and returned to the Chief Registrar, together with the prescribed registration fee. The Industrial and Provident Societies Act of 1893, provides that no society can be registered which does not consist of seven members at least, and for the purpose of registry the application form must be signed by seven members and the secretary. These seven members are referred to in the Model Rules as "the original members."

The receipt by the promoters of an "acknowledgment of registry" from the Chief Registrar marks the coming into being of the society, and it is now enabled to exercise its functions both as regards lending money to its members and borrowing from the Minister. As soon as the society has thus been constituted, its first step will probably be to proceed at once with the allotment of shares in accordance with the society's rules. On allotment the 5s. per share must be paid up by the members, and it is probable that at this point the society will find it necessary to open a banking account in accordance with its rules.

For the next step it may be found most convenient at once to call a summoned general meeting, to elect a committee and officers in accordance with the rules.

The Making of Loans.—As regards the making of loans to members and the application for advances from the Minister, this will necessarily involve very careful consideration by the committee of the society, both as regards the method of making loans, and the appropriate time for making an application for an advance from the Minister. This is a matter of special importance in the early stages of the society's existence. The total funds within the control of the society at the beginning of its existence are:—

1. The entrance fee of 2s 6d. per member.
2. The paid-up share capital of 5s. per share.
3. The money advanced by the Minister of Agriculture, which is limited to a sum equal to the full value of the society's share capital for the time being issued, but on this advance the society must *pay interest* at a rate prescribed in regulations made by the Treasury. This rate is at present fixed at 5 per cent. per annum.

From the foregoing the committee of a society should at once realise that an application for an advance from the Minister should only be made when the money is required for the immediate purpose of making loans to the society's members, otherwise it will hold funds which are lying idle, but upon which it has to pay interest. Before any such application to the Minister is made, therefore, it would seem necessary for the society to consider any applications for loans from its members, and to reach a provisional decision as to the gross amount of such loans which it is prepared to make. It will then be in a position to apply to the Minister for the advance of a definite sum sufficient to enable it to make these loans, but within the limits of £1 for each £1 share held by the members.

The Agricultural Credits Account.—The circumstances just described in which a society makes application to the Minister for an advance in order to make loans to its members, in actual practice will not only occur once or at rare intervals, but will recur repeatedly. Moreover, when any of the loans to members, or part of the loans, are paid off, and the society has no immediate call on the surplus funds, the society will again find itself holding funds upon which it has to pay interest, but for which it has no immediate use. Under Section 2 (3) of the Agricultural Credits Act, provision is made for the opening of an account called the Agricultural Credits Account, into which shall be paid (*a*) such money as may from time to time be provided by Parliament towards defraying the advances and expenses of the Minister directed by this Section to be paid out of the Agricultural Credits Account, and (*b*) all sums received by the Minister in respect of advances made by the Minister under this Section.

This account will be administered by the Ministry of Agriculture. From what has been said above (and this is a point which will be shown even more strongly in the Section which follows) a credit society will not be able to afford to hold any substantial sum which has been advanced to it by the Minister, unless it is immediately required for making loans to members. When, therefore, a loan, or part of a loan, to a member is repaid and any money advanced by the Minister is not immediately required for the purpose of making further loans, it will be advisable for the society to refund this money to the Minister. It is true that the rules provide that a society may invest surplus funds in the Post Office Savings Bank or any savings bank certified under the Trustees Savings Bank Act of 1863, or with the approval of a general meeting in a trustee security, but it will probably be more convenient to refund to the Minister any outstanding advance, rather than to adopt this course.

Administrative Expenses of Society.—This is a point which must also receive the very careful consideration of persons engaged in promoting a society. It is essential to realise that the margin of money out of which the administrative expenses of the society are to be met will necessarily be very small. In the early stages of a society the money available for this purpose will be (*a*) entrance fees of 2s. 6d. per member and (*b*) the interest on loans to members made out of the paid-up share capital of the society, and out of money advanced by the Minister, *less* the interest payable by the society in respect of the Minister's advances and the dividend on the paid-up share capital. This point may be illustrated by the following example :—

Number of members of credit society (say)	100
Average number of shares held by each member (say) ...	20
Total number of shares	2,000
Total paid-up share capital (5s. × 2,000)	£500
Maximum amount which may be borrowed from the Minister	£2,000
Total loanable funds (excluding entrance fees)...	£2,500

Assuming the rate of interest charged on loans to members is 6 per cent., and assuming the total loanable funds are lent to members for the first year, then—

		£	s.	d.
Interest on £2,500 at 6 per cent.	=	£150	0	0
Interest payable on advance from Minister, namely 5 per cent. on £2,000	—	£100	0	0
Net income of Society from loans ...	=	£50	0	0
Entrance fees, 100 members at 2s. 6d.	=	£12	10	0
Total income for first year	=	£62	10	0

Out of this sum the whole administrative expenses of the society, as well as any dividend on the paid-up share capital should be met. It will therefore be clear that a society, the full value of whose share capital is £2,000, will only have a comparatively small sum out of which to meet administrative costs.

Steps are being taken with a view to organising Agricultural Credit Societies, by the Agricultural Organisation Society, 40, Broadway, Westminster, S.W.1, from whom information and assistance in the matter may be obtained. Any further information may be obtained from The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1.

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WILTSHIRE COUNTY EGG LAYING TRIALS.

MAJOR R. F. FULLER.

THE Wiltshire County Council have recently completed their Third Annual County Egg Laying Trials, and a short account of our procedure, some of our difficulties and the results attained will be of interest, especially in those neighbourhoods where similar trials are being arranged.

The Wiltshire scheme was the first of the kind to be put into operation with the approval and support of the Ministry of Agriculture, and commenced in October, 1920. The Horticultural Sub-Committee was asked by the Agricultural Education Committee to take over work in connection with poultry instruction in the county in January, 1920, and at the Sub-Committee's first meeting it was decided to consult poultry keepers as to the steps which might be taken to improve the poultry of the county. At a conference of poultry keepers held in June, 1920, a scheme for holding laying trials in the county was strongly recommended. It will be readily understood that any such scheme requires the full support of local poultry keepers. The scheme was approved by the Ministry in August and the trials were to commence on 1st Oct., 1920, and end on 31st July, 1921.

The trials were intended to discover the standard of efficiency of the poultry in the county and to show the amount of variation; also to form a guide to the individual poultry keepers sending pens of birds as to the efficiency of their poultry, and to show those with low records the desirability of grading up their stock.

In order to be within reach of the county poultry instructor a site was selected on the outskirts of Trowbridge on soil which admittedly was far from ideal for poultry, but which was typical of a good deal of the heavy land in the neighbourhood.

In the first year's trials 50 pens of 4 pullets each were entered and each pen was housed separately. It was found that this manner of housing was too expensive and for the second year's trials, commencing October. 1921, the houses and runs were modified and adapted so that six pens (24 birds) were housed together, thereby saving labour both in feeding and trap-nesting, and at the same time increasing the number of birds in charge of the manager from 200 to 284. The alteration did not seem to make any appreciable difference to the birds.

The first difficulty was that the houses and runs were not quite finished by the date stipulated and the date of commencement had to be postponed until 15th October. This may have contributed to the fact that 70 birds commenced to moult in the first month.

During the first winter laying was severely checked owing to the runs becoming flooded during heavy rains. Surface drains had to be cut to run the water away, and the altered houses were, in September, 1921, moved to another part of the same field. The hot summer of 1921 was hard on the houses, and during the early part of the following winter we were troubled occasionally by the wet getting in. The third year's trials were held on the same site as in the second year, and the runs, 32 yards long by 18 yards wide, were in quite good condition.

The Committee considered the results of the first year's trials quite satisfactory from an educational point of view. An average of sixty to seventy local poultry keepers per week attended at the trial ground and took a great interest in the methods of management, etc., and, in the opinion of the poultry instructor, small poultry keepers obtained greater benefit from such visits to the trial ground than from lectures. Visitors have in the past been allowed at any time on week days, but it is found that this sometimes interferes with the work of the manager and in future it is proposed to limit visits to two days per week except by appointment with the county poultry instructor.

In order to increase the interest in the trials, Cups and other prizes for pens and birds showing the best score value were provided privately from non-county funds. These prizes the Committee decided should be based on the value of eggs produced rather than the number, in order to emphasise the importance of breeding pullets that lay first grade eggs during the period of high prices. The eggs were graded in accordance with the methods of the National Utility Poultry Society and priced each week according to the prices published in the Ministry's *Agricultural Market Report*. In the future the grading of eggs will be as decided at the Conference of representatives of the various laying trials at Harper Adams College, held on 5th April last.

The birds were fed with 1 oz. of corn per head (wheat, broken maize and oats) in their litter in the mornings and the same in the afternoons, and during the first two years a wet mash of mixed meals in the middle of the day. Dry mash hoppers were open from 10 a.m. During the third year the wet mash was omitted. The total quantity of mixed corn and meal consumed during the first year averaged 3·84 oz. per day per bird, costing 4d. per bird per week; during the second year the corresponding figures were 4 oz. per day per bird, costing 2¾d. per bird per week; and during the third year 4·5 oz. per day per bird, costing 2½d. per bird per week. The rations were not intended to be in any way forcing and the birds were in a good healthy condition at the end of the trials.

The health of the birds has, on the whole, been quite satisfactory, the casualties averaging 9 per year. They were higher during the last year, owing to an unfortunate outbreak of roup. The following figures showing the number of birds that did not lay at all during each of the months of the third year in consequence of sickness, moulting, broodiness or immaturity may be of interest:—

Month of 4 weeks.

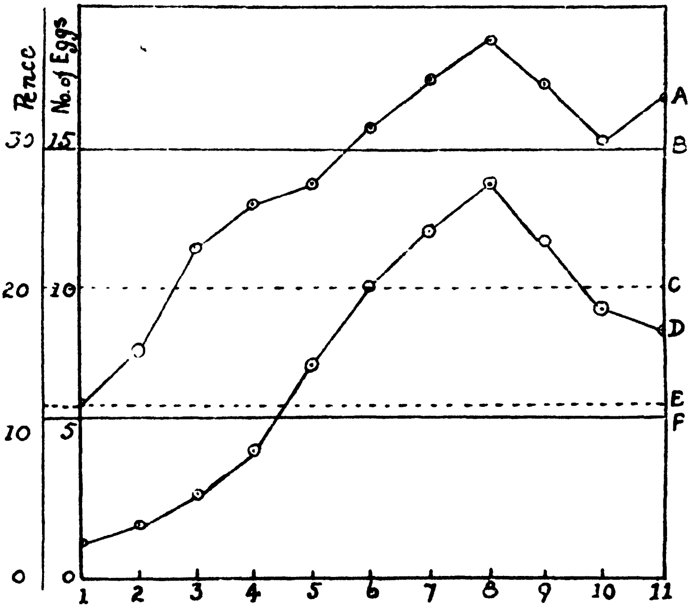
1st	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*	*11th*
209	211	121	85	40	14	12	14	24	21	21

With regard to selection, it is thought that our results emphasise clearly the difficulty of picking out the best layers from immature pullets. The difficulty is that birds that have commenced to lay run the risk of at least a partial moult in consequence of the changed conditions; it is difficult also to estimate the laying capability of immature birds, and if immature it seems that the change is apt to delay the commencement of laying until the price of eggs has appreciably dropped. Broodiness is frequently a handicap, particularly to some breeds. For the small breeder it is recognised that broody hens are required at the right time, but it is not advisable for the tendency to broodiness to be carried to extremes; we have in some cases had birds that have been reported broody during five and six consecutive months.

The results of the trials as regards laying capabilities, while scarcely comparable with the National Trials, indicate clearly the extent to which local poultry could be improved. They emphasise the great importance of good laying strains and of culling the poor layers, and prove that suitable pullets can be kept profitably even on unsuitable sites. A summary of the results is given on page 659.

With regard to the importance of culling and of trap-nesting in order to cull on the surest lines, the comparisons between the 12 best pens and the 12 worst pens in the summary of results are interesting.

The average gross profit per bird, viz., difference between average cost of food and value of eggs at London Market prices, was as follows:—19s. per bird for the best pen; 14s. per bird average for the 12 best pens; 8s. per bird average for the 12 worst pens; loss 1s. 4d. per bird for worst pen. The following chart clearly shows the possibilities as regards improvement:—



Months of 4 weeks October to July.

A.—Average Eggs per bird per month of 4 weeks of the 12 pens producing the highest number of eggs.

B.—Average Score Value per bird per month of 4 weeks of the 12 pens producing the highest score value, 2s. 6d.

C.—Average Value of Eggs sold locally per bird per month of 4 weeks, 1s. 8½d.

D.—Average Eggs per bird per month of 4 weeks of the 12 pens producing the lowest number of eggs.

E.—Average Cost of Food per bird per month of 4 weeks, 1s. 0½d.

F.—Average Score Value per bird per month of 4 weeks of the 12 pens producing the lowest score value, 11½d.

Another point which the Committee consider important is that local trials on these lines give the county poultry instructor an opportunity of putting into practice the principles of feeding and management which he advocates in his itinerant lectures. This point may not be as important in counties where there is a Farm Institute, but in all branches of agricultural education there is no doubt that the efforts of instructors and advisory officers are greatly helped if they have an opportunity of putting into practice the principles they preach.

As regards the future, the Committee's scheme for next year has been approved by the Ministry, which gives a grant of two-thirds of the capital expenditure as well as two-thirds of the salary of the manager. As a result of the Committee's experience in the past it has been decided to obtain new houses of larger size designed to accommodate an increased number of birds without increased labour. The houses are being made in sections so as to be able to move to different neighbourhoods in the county from time to time. They are to be 10 ft. × 20 ft., accommodating in each half five pens of five birds each, and it is expected that the manager will be able to look after at least 300 birds.

The site selected for next year's trials is on greensand soil at West Lavington, near the Dauntsey Agricultural College, and it will be interesting to be able to show in the future the difference due to the change to a soil more suitable for poultry keeping, while in addition to the interest the trials will undoubtedly create in a new neighbourhood it is hoped that they will be also of considerable interest to the students of the Dauntsey College.

Wiltshire, unfortunately, cannot claim to be one of the leading counties as regards poultry keeping, but there is no doubt that there has been a great increase in the interest taken in the subject during the last three years. As far as is known to the county poultry instructor, there were less than 20 trap-nests in use in the county three years ago—now there are 2,000 in use. It cannot be claimed that our County Laying Trials are entirely responsible for this, but the trials are at least responsible for a share in the progress. The progress has also been helped by the formation of the Wiltshire Poultry Breeding and Egg Recording Society, formed on the lines of the scheme of Co-operative Extension Work in Agriculture and Home Economics of the State of Connecticut, U.S.A.

SUMMARY OF RESULTS OF 3 YEARS' TRIALS.

	1st Year (40 weeks).					*2nd Year (44 weeks).*					*3rd Year (44 weeks).*				
	No. of eggs laid.					*No. of eggs laid.*					*No. of eggs laid.*				
	Grade.			*Score*	*Score*	*Grade.*			*Score*	*Score*	*Grade.*			*Score*	*Score*
	1st.	*2nd.*	*3rd.*	*Number.*	*Value.*	*1st.*	*2nd.*	*3rd.*	*Number.*	*Value.*	*1st.*	*2nd.*	*3rd.*	*Number.*	*Value.*
Heavy Breeds—Pen of 4 Birds.					£ s. d.					£ s. d.					£ s. d.
Gold Medal	406	232	3	486	7 3 11	481	193	11	561	5 18 3	688	58	1	746	6 5 7
Silver Medal	423	79	0	502	6 12 2	437	109	0	517	5 12 4	662	21	0	683	5 18 0
Bronze Medal	393	140	1	473	6 6 5	449	155	1	529	5 10 11	608	34	0	642	5 3 11
Individual Birds.															
Gold Medal	165	25	0	185	2 11 3	181	16	1	197	2 3 8	199	5	0	204	1 14 8
Silver Medal	133	32	1	153	2 3 10	183	21	0	203	2 2 9	192	0	0	192	1 12 10
Bronze Medal	147	14	0	161	2 2 11	143	22	0	163	1 17 0	186	6	0	192	1 12 9
Light Breeds—Pen of 4 Birds.															
Gold Medal	457	89	1	537	7 12 4	568	112	0	648	6 4 7	503	98	1	583	4 9 5
Silver Medal	431	85	1	511	6 18 8	496	69	0	565	5 1 7	502	91	3	582	4 8 6
Bronze Medal	403	94	0	483	5 18 5	516	54	0	570	5 0 9	481	69	1	550	4 1 10
Individual Birds.															
Gold Medal	144	2	0	146	2 2 10	142	61	0	162	1 15 7	167	11	0	178	1 7 1
Silver Medal	124	23	0	144	2 2 0	147	41	0	167	1 12 5	165	0	0	165	1 6 3
Bronze Medal	123	37	0	143	2 0 0	131	49	0	151	1 12 3	153	13	0	166	1 4 6
AVERAGE OF 12 BEST PENS ...	395	133	3	470	6 6 0	460	130	2	532	4 18 8	535	73	2	597	4 13 0
AVERAGE OF ALL PENS ..	291	170	10	365	4 16 2	280	144	7	347	3 1 9	325	152	5	391	2 18 0
AVERAGE OF 12 WORST PENS	171	254	26	247	3 9 6	101	207	6	169	1 5 11	111	236	6	181	1 5 11

TABLE II.

Breed.	*Breed Averages—No. of Eggs laid per Bird.*		
	1920-21.	1921-22.	1922-23.
Anconas	107	114	100
White Leghorns	86	113	125
White Wyandottes	90	105	125
Rhode Island Reds	92	118	126
Light Sussex	103	80	90

NOTES ON MANURES FOR OCTOBER.

SIR JOHN RUSSELL, D.Sc., F.R.S.,
Rothamsted Experimental Station, Harpenden, Herts.

Town Refuse Experiments.—Some interesting experiments are being made this year at Rothamsted to compare the effect of ashpit refuse from towns (already described in this *Journal*)* with town stable manure. The crop grown is mangolds, and the manures were applied all at the same rate, namely, 15 tons per acre. The difference in cost was considerable; the ashpit refuse cost nothing, while the town stable manure cost 3s. 9d. per ton; in both cases, however, there was carriage and carting to be paid for, making a total of 10s. per ton on the farm for the stable manure and 6s. 3d. per ton for the refuse. Up to the present there is no difference whatever to indicate that the ashpit refuse will be inferior to stable manure. The condition of the soil is just as good, there has been an equally good growth of plant and equally few gaps. It still remains to be seen whether ashpit refuse will last as well as stable manure, but up to the present the indications are favourable.

It is not the purpose of these notes to " boom " town waste as a manure. We have already heard of one case where an enterprising town authority is inviting farmers to pay 2s. 6d. per ton free on rail for its refuse. A price of this kind cannot be justified. Seeing that the town authority must dispose of its refuse somehow, it is only reasonable that they should put it on rail free of charge, and indeed they should help to bear the burden of the carriage. Five or 6s. per ton on the farm is as much as town refuse is likely to be worth at present prices of other manures.

Spring Dressings.—At Rothamsted this year spring dressings of nitrogenous fertilisers to corn crops have shown up quite well, and it has again appeared, contrary to some of the previous results, that the later applications have been rather more favourable to crop yields than the earlier ones. A great deal must depend on the soil and season, and it is desirable that much fuller information than we have at present should be obtained, for it is a little difficult to understand the results as they stand. The present position is that one can safely recommend spring dressings as being likely to increase winter corn crops, but we are not yet in a position to state exactly what is the best time for applying them. On the other hand, it appears that the top dressing given to potatoes was not as effective as the same quantity of dressing applied with the seed. In 1922, for example, the potatoes receiving no nitrogen but only the basal dressing of potash phosphates and dung gave 6.1 tons per acre. The addition of 3 cwt. of sulphate of ammonia with the seed raised this to 9.7 tons, but when the 3 cwt. were divided into two dressings of 1½ cwt. each, one applied with the seed and the other given later as top dressing, the yield was only 8.6 tons per acre.

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* Nov., 1922, p. 685; Dec., 1922, p. 838; Jan., 1923, p. 944.

Potash as a Fertiliser for Mangolds.—Barnfield plots this year showed striking advantages from potash dressings, and from the comments made by agricultural visitors it seems clear that many farmers do not appreciate the importance of potash for this particular crop. The plants to which no potash was given are not as large nor as healthy as those receiving potassic fertilisers, even though they have been pretty well treated with farmyard manure. There is a tendency for the leaves to be darker and more crinkly, also a tendency for orange streaks to appear in the stems. Provision should always be made for the mangold crop to receive a sufficient dressing of kainit or muriate of potash. Suitable amounts are 5 cwt. of kainit, or 1½ cwt. of muriate of potash, or 3 cwt. of French extra kainit. In many cases salt is a useful addition also.

Mineral Phosphates.—Mineral phosphates are attracting a good deal of attention at present, and a number of experiments are being made in different parts of the country to ascertain their value to farmers.

In a set of experiments with swedes in Radnorshire, Mr. David Thomas reports the following yields :—

Plot 7.	Control (no phosphate)	8 tons per acre.
Plot 1.	Superphosphate	12 tons ..
Plot 6.	Basic Slag	12·7 tons per acre.
Plot 4.	Gafsa Phosphate	10·9 tons „

from which it appears that although Gafsa is not as good as superphosphate or slag, it nevertheless served a useful purpose. Other mineral phosphates were not quite so good.

There is considerable evidence that the phosphates must be very finely ground to ensure good results.

The Proper Time to use Farmyard Manure.—A correspondent asks what is the best time for putting farmyard manure on the land, and on our informing him that he should as a rule apply it in autumn or winter if in the dryer parts of England, but that he can apply it in spring if the winter is mild and wet, replies that he cannot readily draw it out in winter on his heavy land, and if he held it over till the following autumn he would have to wait for a long time ahead before deriving any benefit from it.

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* Radnorshire County Council, Report on Agricultural Work, 1923.

The advice to apply farmyard manure in autumn or winter must, of course be modified whenever circumstances would make the plan more costly than the saving would justify. The clay farmer cannot get his manure on to the land as easily as is possible for anyone farming on lighter soil. If the land happens to be dry in the latter part of the winter, he can readily apply the manure for the mangold crop. but if it is wet there is more difficulty. He could. however, often use it with advantage on the clover leys so long as he does not cut them up too badly. Whatever plan he makes it must be admitted that a heavy land farmer might easily have difficulty in using farmyard manure after February, and might then have to store it. A certain number of cow-keepers are now cutting up straw into short lengths of about 4 in., and this practice certainly improves the manure and facilitates decomposition in the soil, so that later dressings can be given.

Selection of Potash Fertilisers: Present Position.—Experimental work is now proceeding at a number of centres in regard to potash fertilisers, and precise information is being accumulated which will enable the farmer to make a selection suitable to his farm and his crops. The present position is broadly as follows:—

1. Kainit can be used for mangolds on practically all soils; for cereals and leguminous crops on light chalky soils. The amount necessary depends on the composition of the fertiliser, but would be 3 to 5 cwt. per acre of ordinary kainit, or proportionately less of the French extra kainit containing 20 per cent. of K_2O.

2. Muriate of potash can be used for practically any agricultural crop or any soil. It usually gives as good a crop as sulphate of potash, but may not give as good a quality.

3. Sulphate of potash is safest for potatoes where quality is a consideration; it can also be used for horticultural purposes, glass-houses, etc., and is generally associated with good quality of

produce. The following results were obtained at Kirton in 1922:—

Manures.	*Yield per Acre.* Ware.			*Total (Ware, Seed and Chats).*		
	T.	c.	lb.	T.	c.	lb.
1. No Potash	4	9	24	6	4	80
2. Sulphate of Potash ...	7	19	104	10	0	16
3. Muriate of Potash ... 80% Ordinary Commercial	8	1	70	10	2	70
4. Muriate of Potash 97%	8	3	64	10	4	104
5. Kainit 14%	6	10	56	8	3	0

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending September 12th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.10	13.15	13.10	12.17	16. 7
„ „ Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 7*	13. 7*	13. 7*	13. 7*	(N)12.10
„ „ „ neutral (A. 25¾ per cent.)	14.10*	14.10*	14.10*	14 10*	(N)13. 8
Kainit (Pot. 12½ per cent.)	...	..	...	1.14	2. 8
„ (Pot. 14 per cent.)	2. 2	...	2.10	2. 5	3. 3
Sylvinite (Pot. 20 per cent.)	...	..	...	2.10	2. 6
Potash Salts (Pot. 30 per cent.)	...	.	...	3.10	2. 4
„ „ (Pot. 20 per cent.)	...	...	...	2.10	2. 6
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 0	8. 0	7. 0	2 10
Sulphate of Potash (Pot. 48 per cent.) ...	...	..	11 15	10.15	4. 6
Basic Slag (T.P. 35 per cent.)	...	...	...	3 12§	2. 1
, „ (T.P. 30 per cent.)	..	...	...	3. 0§	2. 0
„ „ (T.P. 26 per cent.)	2.13§	2.10§	...	...	...
„ „ (T.P. 24 per cent.)	2. 9§	2. 4§	2. 2§	...	...
„ „ (T.P. 20-22 per cent.)	...	2. 1§	.	2. 7§	2. 4
„ „ (T.P. 18 per cent.) ...	2. 3§	...	1.15§	...	...
Slag Phosphate (T.P. 60 per cent.)	...	...	...	5.12	1. 9
Superphosphate (S.P. 35 per cent.) ...	3.17	...	3.15§	3. 7	1.11
„ (S.P. 30 per cent.) ...	3.10	...	3. 7§	3. 0	2. 0
Bone Meal (T.P. 45 per cent.)	9.10	...	8.15	8.10	...
Steamed Bone Flour (T.P. 60 per cent.) ..	8 10†	...	6.15	6.10	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.10	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.= Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

MONTHLY NOTES ON FEEDING STUFFS.

E. T. Halnan, M.A., Dip. Agric. (Cantab.),
Animal Nutrition Institute, Cambridge University.

Milk Production of Sows.—The chief care of the successful pig feeder is to keep the breeding sows in good condition both during pregnancy and particularly during the suckling period, so that the piglings when weaned are in a healthy thriving condition. In order to obtain a quick maturing, good quality finished porket or bacon pig it is essential that the weaned pigling should be well nourished during the suckling period.

The capacity of a sow to raise large well-developed litters depends upon her ability to produce the necessary milk. Carlyle at the Wisconsin Experiment Station, and Braxton and Jones, working at the Purdue University under the direction of Professor W. W. Smith, have studied this problem, working with Berkshires, Razor-backs, Poland Chinas and Durocs. The method adopted was to keep the sow and litter separate, and to weigh the piglings immediately before and after each nursing, thus obtaining a measure of the milk produced. The results of these experiments showed that there is considerable variation in the milk capacity of individual sows, as there is in ordinary milch cows, and, as would be expected, the sows which produced the most milk produced the largest litters. The number of piglings in the litter and the weight at weaning time therefore gives a very good indication of the milk capacity of the sow. In the experiments in question the average daily production of milk per sow, on a 10 weeks suckling period, worked out at 5.53 lb., giving a total production of 387 lb. of milk during the suckling period. The amount of milk given by different sows varied from 3.39 lb. to nearly 8 lb. daily. It will be seen that during the suckling period the sow gives half a gallon of milk a day. which fact emphasises the importance of feeding the sow well during the suckling period on materials rich in milk-producing constituents. Sow's milk is considerably richer in protein, ash and fat than cow's milk, the total solids of sow's milk being 19 per cent. as compared with 13.6 per cent. in cow's milk. According to Henry and Morrison the percentage composition of cow's milk and sow's milk is as follows:—

	Solids.	*Fat.*	*Protein.*	*Milk sugar.*	*Ash.*
Cow's milk ...	13·60 ...	4·4 ...	3·5 ...	5·0 ...	0·7
Sow's milk ...	19·00 ...	6·7 ...	5·9 ...	5·4 ...	1·0

DESCRIPTION.	Price per Qr.		Price per			Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.								
	s.	lb.	s	£	s.	£	s.	£	s.		s.	d
Wheat, British	—	—	9/4	9	7	0	15	8	12	71·6	2/5	1·29
Barley, British Feeding	—	—	7/8	7	13	0	12	7	1	71	2/–	1·07
„ Danubian „	29/6	400	8/3	8	5†	0	12	7	13	71	2/2	1·16
Oats, English, White	—	—	10/6	10	10	0	13	9	17	59·5	3/4	1·78
„ „ Black and Grey	—	—	8/4	8	7	0	13	7	14	59·5	2/7	1·38
„ Canadian No. 2 Western	28/9	320	10/1	10	2	0	13	9	9	59·5	3/2	1·70
„ No 3 „	27/9	„	9/9	9	15	0	13	9	2	59·5	3/1	1·65
„ Feed	27/6	„	9/8	9	13	0	13	9	0	59·5	3/–	1·61
„ American	24/–	„	8/5	8	8	0	13	7	15	59·5	2/7	1·38
„ Argentine	24/–	„	8/5	8	8	0	13	7	15	59·5	2/7	1·38
Maize, American	43/6	480	10/2	10	3†	0	13	9	10	81	2/4	1·25
„ Argentine	35/9	„	8/4	8	7	0	13	7	14	81	1/11	1·03
Beans, Rangoon	—	—	7/4	7	7†	1	11	5	16	67	1/9	0·94
Millers' offals :—												
Bran, British	—	—	—	5	15	1	6	4	9	45	2/–	1·07
„ Broad	—	—	—	6	10	1	6	5	4	45	2/4	1·25
Middlings, Coarse, British	—	—	—	8	7	1	2	7	5	64	2/3	1·20
Pollards, Imported	—	—	—	5	15†	1	6	4	9	60	1/6	0·80
Meal :—												
Barley Meal	—	—	—	9	12	0	12	9	0	71	2/6	1·34
Maize „	—	—	—	11	0	0	13	10	7	81	2/7	1·38
„ Germ Meal	—	—	—	9	0	0	18	8	2	85·3	1/11	1·03
„ Gluten-feed	—	—	—	8	12	1	6	7	6	75·6	1/11	1·03
Locust Bean Meal	—	—	—	8	0	0	9	7	11	71·4	2/1	1·12
Bean Meal	—	—	—	12	10	1	11	10	19	67	3/3	1·74
Fish „	—	—	—	17	0	4	6	12	14	53	4/10	2·59
Linseed	—	—	—	20	12	1	10	19	2	119	3/3	1·74
„ Cake, English 9°/o	—	—	—	11	13	1	17	9	16	74	2/8	1·43
Cottonseed Cake, English 5½°/o	—	—	—	7	12	1	14	5	18	42	2/10	1·52
„ „ Egyptian 5½°/o	—	—	—	7	5	1	14	5	11	42	2/8	1·43
Decorticated Cottonseed Meal 7°/o	—	—	—	11	12	2	13	8	19	71	2/6	1·34
Coconut Cake 6°/o	—	—	—	8	10	1	10	7	0	73	1/11	1·03
Ground Nut Cake 7°/o	—	—	—	8	10	1	15	6	15	56·8	2/5	1·29
Palm Kernel Cake 6°/o	—	—	—	5	10†	1	3	4	7	75	1/2	0·62
„ „ Meal 2°/o	—	—	—	5	0	1	4	3	16	71·3	1/1	0·58
Feeding Treacle	—	—	—	6	5	0	8	5	17	51	2/4	1·25
Brewers' Grains :—												
Dried Ale	—	—	—	6	2	1	4	4	18	49	2/–	1·07
„ Porter	—	—	—	5	15	1	4	4	11	49	1/10	0·98
Wet Ale	—	—	—	1	1	0	9	0	12	15	0/10	0·45
„ Porter	—	—	—	0	18	0	9	0	9	15	0/7	0·31
Malt Culms	—	—	—	6	10	1	13	4	17	43	2/3	1·20

† At Liverpool

NOTE—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of August and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 12s. 7d.; P_2O_5, 4s. 4d.; K_2O, 2s. 4d.

The nutritive ratio of sow's milk on the basis of the composition given above works out at 1 : 3.5, so that it becomes necessary to feed the brood sow on a mixture having a fairly narrow ratio, and in view of the demand upon the sow for milk, a very liberal amount of food should be given. This is in accord with the experience of practice, it being commonly held by all successful pig breeders that you cannot do a brood sow too well during the suckling period. The practical advice which can be given as the result of the above experiments is: Breed for milk capacity from the sows which give large litters and finish them well as weaned piglings; feed the sows well on a mixture of meals to which a protein-rich feeding stuff has been added; and, above all, do not stint the brood sows for food during the suckling period, since a stinting policy at this time has to be more than paid for at a later period.

FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s	£ s	£ s.		s. d.	d.
Wheat - - - - -	7 12	0 15	6 17	71·6	1 11	1·03
Oats - - - - -	6 7	0 13	5 14	59·5	1 11	1·03
Barley - - - - -	7 8	0 12	6 16	71·0	1 11	1·03
Potatoes - - - -	1 18	0 3	1 15	18·0	1 11	1·03
Swedes - - - -	0 15	0 2	0 13	7·0	1 11	1·03
Mangolds - - - -	0 14	0 2	0 12	6·0	1 11	1·03
Good Meadow Hay - -	3 15	0 13	3 2	31·0	2 0	1·07
Good Oat Straw - - -	2 0	0 6	1 14	17·0	2 0	1·07
Good Clover Hay - -	4 4	1 0	3 4	32·0	2 0	1·07
Vetch and Oat Silage - -	1 15	0 7	1 8	14·0	2 0	1·07

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Farmers' Visits to Rothamsted Experimental Station.

THE Director of the Rothamsted Station wishes to remind farmers and others interested in agriculture that the field experiments on the manuring of root crops conducted at Rothamsted provide at this time of the year a very striking series of demonstration plots. The most important of these experiments are:—

(1) *Potatoes*

(*a*) The effects of various potash manures (sulphate of potash, muriate of potash, kainit, sylvinite, etc.).

(*b*) The effect of increasing dressings (from nothing up to 4½ cwt. per acre) of sulphate of ammonia in a complete fertiliser on the yield and quality of the tubers.

(*c*) Comparative trials with certain new fertilisers.

(*d*) Comparisons of yields from seed potatoes fresh from Scotland with those from once grown seed.

(2) *Mangolds*

(*a*) The fertilising value of certain types of town refuse as compared with dung.

(*b*) Continuous mangolds (47th year). Showing the effects of various manurial schemes.

(3) *Swedes*

The use of sulphate of ammonia as a top dressing to supplement phosphates, potash, and dung applied at sowing time.

(4) *White Turnips*

Comparisons of various green manuring crops (mustard, tares, trifolium, etc.), as a preparation for roots. It is desired to find out how far dung can be substituted by green crops ploughed in.

The Secretary of the Station will be glad to arrange for farmers' parties of any size to be conducted round the experimental plots at any time before lifting. In cases, however, where it is difficult to fix a date in advance, farmers are invited to go at their own convenience, and the necessary arrangements will be made on arrival. At least three hours should be allowed for a tour round the farm. Lunch and tea can readily be obtained in Harpenden. The Midland Railway Station (Harpenden) is about half a mile from the Laboratory and the Great Northern Station about two miles. Farmers going by road will find the Laboratory on the west side of Harpenden Common.

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REPLIES TO CORRESPONDENTS.

Formaldehyde and Fruit Tree Pests.—E.T. asks whether formaldehyde is of any use against insect pests or fungi of fruit trees.

Reply : It is of no use against insect pests of fruit trees and there do not appear to be any records of it being used against fruit fungi.

Digestibility Trials of Feeding Stuffs.—F.S. asks whether the figures given for digestibility in the Ministry's Miscellaneous Publication No. 32 *(Rations for Live Stock)* are theoretical or based on actual trials, and if the latter, what animals were used.

Reply : The figures given are average figures from experiments carried out with cattle or sheep, which differ very little from one another in their power of digestion. Pigs differ from cattle and sheep appreciably but not very greatly ; the number of digestibility experiments which have been made with pigs is not very large. Tables of digestibility of foods when fed to pigs are given in Kellner's "Scientific Feeding of Animals," Henry & Morrison's "Feeds and Feeding," and Armsby's "Principles of Animal Nutrition."

Sainfoin.—G.R. asks whether it is a fact that sainfoin should not be sown on the same land without a long interval intervening.

Reply : In the absence of adequate evidence to the contrary it would be advisable to respect the general opinion to the extent at least of allowing the land to be free of the crop for the same length of time as it has borne it.

Bacterial Fertilisers.—H.Q. asks for information as to bacterial fertilisers for use with cereals.

Reply: In a lecture, delivered at Weimar in June, 1921, Professor Lemmermann, of Berlin, divided bacterial manures into two classes:—(1) those intended for inoculation of leguminous plants; (2) those intended for use with other plants. As regards the latter he concluded:—"All the inoculation manures advertised for use with other than leguminous plants, with corn, root crops, potatoes, etc., cannot accordingly be recommended, but, on the basis of our present knowledge, a warning must be given against their employment."

Lime in Basic Slag.—J.P. asks the percentage of free lime in present-day slag.

Reply: While an analysis of old-fashioned slag would probably show from 40–50 per cent. of lime only a very small proportion of this would be free lime. The proportion of free lime in present-day slag is likewise very small, probably 2 or 3 per cent.

Oil from Home-grown Linseed.—K.O. asks about oil-content of home-grown linseed.

Reply: The oil-content of linseed forms the subject of a paper in Vol. VII (March, 1915) of the Journal of Agricultural Science, and of an article in this *Journal*, February, 1916. In this article reference is made to the prevalence of a belief that "linseed grown at home contains appreciably less oil than that which is usually imported." This belief is shown by figures of trials to be without foundation.

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Foot-and-Mouth Disease.—*Bedfordshire.*—No further outbreaks having occurred, all general restrictions imposed in connection with this group of outbreaks were withdrawn on 9th September.

Hampshire (Alton district) and Surrey.—There have been no fresh developments in this area and the restrictions were withdrawn on 15th September.

Yorkshire West Riding.—Disease was found to exist at Templeborough, Rotherham, on 27th August, the affected animals consisting of pigs kept in a hotel yard. There have been no further developments in this area, and the usual restrictions which were imposed were withdrawn on 27th September.

Lancashire.—On 28th August, an outbreak occurred at Norbreck, Blackpool, and on 30th August, a further outbreak occurred at Claughton, Garstang, which was within the original prohibited area, but at its extremity. It was therefore necessary to extend the area under restrictions. In the extended area, further outbreaks occurred, namely:—on 3rd September at Carleton, Poulton-le-Fylde (two), and Bispham, on 6th September at Bispham and at Carleton, on 7th September at Leyland, on 8th at Carleton, on 13th at Rossall, and on 18th at Bispham.

Cheshire.—On 4th September, disease was confirmed at Shavington near Crewe in animals which had arrived at Fleetwood from Ireland on 28th August. These cattle had been unloaded at Crewe on 1st September and as Crewe market was held on 3rd September the possibility of further outbreaks arose. Arising out of the distribution of animals via Crewe, further outbreaks were confirmed at Wistaston on 6th September in cattle which had used the same railway siding as the Shavington animals, on 7th September at Weston, on 8th at Calveley and on 9th at Basford, Nantwich (two), and Wistaston.

In all cases the animals had been purchased in Crewe market or had passed through the Crewe loading docks, subsequently, further outbreaks have occurred in the vicinity of those referred to, bringing the total in this area to 22.

Bucks.—The initial outbreak in this area at Wotten Underwood on 7th September, was directly due to the movement of sheep from Crewe. This outbreak gave rise to others in the vicinity on 10th September at Waddesdon and Wotten Underwood, and on 13th and 14th September at Kingswood, Aylesbury.

Southampton district.—Commencing on 4th September, a fresh series of outbreaks was brought to light by the confirmation of disease at West End, Southampton. Further outbreaks occurred at West End on 5th, 6th, 7th and 10th September, all the premises being in close proximity to those on which disease first appeared.

Devonshire—Four outbreaks have been confirmed in the Torquay district, two on premises in the occupation of the same owner, at Torquay and Cockington on 6th September, and two on 7th and 12th September at Cockington, which were probably due to the movement of animals from one of the former outbreaks.

Following upon the initial Cheshire outbreak, the existence of disease was confirmed on the Landing Place for Irish animals at Fleetwood on 4th September, and the Ministry accordingly prohibited entirely the landing of animals from Ireland. Arrangements were immediately made for tracing the affected animals back to the place of origin in Ireland, but exhaustive enquiries failed to indicate that foot and-mouth disease existed in Ireland. and the Ministry reached the conclusion that disease was introduced into the Landing Place from one of the local centres of infection in the Blackpool district.

In the circumstances the Ministry issued an Order on 7th September, taking immediate effect, withdrawing the prohibition on the landing of animals from Ireland, and permitting importation under the usual conditions except as regards certain ports in contiguity to outbreaks.

Map of Wart Disease Infected Areas.—The Ministry has issued a map showing the principal districts which are scheduled as infected areas under the Wart Disease of Potatoes Order of 1923. This map will be of particular value to dealers in potatoes, since the movement of potatoes from the infected areas to other districts is prohibited except as regards potatoes of immune varieties for ware purposes. A list of the areas is appended to the map, copies of which can be obtained from the Offices of the Ministry, 10, Whitehall Place, London. S.W.1, price 6d., post free.

List of Potato Varieties.—The Ministry is informed that a list of the names of all the known varieties of the potato, together with their synonyms, has been compiled by the Board of Agriculture for Scotland. The list comprises 1,300 names, and indicates whether the varieties are immune from or susceptible to wart disease, in all cases where that fact is known. There is no doubt that the publication should be of considerable value to potato growers, merchants, and to the trade in general. Copies can be had on application to the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

National Rat Week.—The week beginning Monday, 5th November, 1923, has been fixed by the Ministry as "Rat Week." The object is to secure by organised and simultaneous action throughout the country the largest possible destruction of rats. It also affords an opportunity of calling public attention to the damage caused by them and of reminding the public that it is the duty of all occupiers of premises infested with rats and mice to destroy these pests. Where they fail to do so voluntarily, the Local Authority may put into operation their powers under the Rats and Mice (Destruction) Act, 1919.

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NOTICES OF BOOKS.

A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States.—(R. B. Thomson and H. B. Sifton: Univ. of Toronto Press, 1922). The authors are to be congratulated on the production of an excellent and nicely illustrated little work, mainly intended, it is true, for readers in Canada and the United States, but giving useful information on many plants which are also common in Britain. The plan of the book is to deal in turn with plants dangerous when included in hay and coarse feeds, plants dangerous in pasture or on the range, those dangerous in ground feeds, and those which are rarely observed to cause death in animals. Each species is dealt with with reference to its relationship to Canadian and United States farming, and the information given is practical and clearly written. It is worthy of notice that whereas so many books nowadays are cheaply produced the work under notice is well printed on art paper and enclosed within a limp linen cover—a pleasure to handle.

The Story of the Maize Plant.—(Paul Weatherwax, Chicago: Univ. of Chicago Press, $1.75). This excellently produced little book is really of chief interest for American readers, or those in the numerous countries where maize can be successfully ripened and is extensively grown. Certain parts of it, howeyer, are of interest to British readers, for one chapter deals with the products and uses of the maize plant, though the space devoted to it as a food for live stock is but a brief sketch. The same remark may be made of the references to ensilage and pasturing of the crop. The volume nevertheless deals systematically with the origin and botanical characteristics of the plant, its cultivation and growth, the green plant and the seed, heredity, and breeding, and generally with maize in its relation to man, forming a clearly written and attractive account of one of the world's most wonderful food plants. Maize has become an important grain food on British farms, and the green crop where successfully grown in the southern counties is a highly valuable fodder, especially for milch cows or pigs, while it may very successfully be stored in the form of silage. Any book therefore that will help us to understand it better is welcome, and Weatherwax brightens his story with apt references to the legendary origin of maize as a food crop, until in the words of Bayard Taylor it became

> "The annual storehouse of a nation's need,
> From whose abundance all the world may feed."

ADDITIONS TO LIBRARY.

Agriculture, General and Miscellaneous.

Dunlop, J.—American Agriculture and Some Hints Therefrom. (8 pp.) Glasgow: Scottish Agricultural Publishing Co., 1923, 6d. net. [63(73).]

Coulter, M. C.—Outline of Genetics with Special Reference to Plant Material. (211 pp.) Chicago: University Press; Cambridge: University Press, 1923, 7s. 6d. [575.1(02).]

Griffith, J. J.—Lime and Liming. (9 pp.) Bath: Herald Press, 1923. [63.15.]

National Institute of Agricultural Botany.—Methods of Seed Analysis. (15 pp.) Cambridge, 1923, 1s. [63.1951.]

Field Crops.

Leppan, H. D., and *Bosman, G. J.*—Field Crops in South Africa. (360 pp.) Johannesburg: Central News Agency, Ltd., 1923, 21s. net. [63.3(02); 63(68).]

Stapledon, R. G.—The Cultivation and Varieties of Oats. (17 pp.) Bath: Herald Press, 1923. [63.314(04).]

Weatherwax, P.—The Story of the Maize Plant. (260 pp.) Chicago: University Press, 1923, $1.75. [63.315(02).]

Stuart, W.—The Potato: Its Culture, Uses, History, and Classification. (525 pp.) Philadelphia and London: J. B. Lippincott Co., 1923, 12s. 6d. [63.512(02).]

Scotland Board of Agriculture.—Miscellaneous Publications No. 3:—The Maintenance of Pure and Vigorous Stocks of Varieties of the Potato. (64 pp.) Edinburgh, 1923, 1s. net. [63.512(04).]

Colorado Agricultural Experiment Station.—Bulletin 281:—Methods of Handling Hay in Colorado. (39 pp.) Fort Collins, 1923. [63.1982.]

Horticulture.

Mourre, C.—La Lavande Française: sa Culture, son Industrie, son Analyse. (170 pp.) Paris: Gauthier-Villars et Cie., 1923. [63.345.]

U.S. Department of Agriculture.—Farmer's Bulletin 1320:—The Production of Cucumbers in Greenhouses. (29 pp.) Washington, 1923. [63.513(04).]

Plant Diseases.

Food Investigation Board, Department of Scientific and Industrial Research.—Special Report No. 12:—Brown Heart—A Functional Disease of Apples and Pears, *Franklin Kidd* and *Cyril West.* (36 pp. + xix plates.) London: H.M. Stationery Office, 1923, 4s. 6d. net. [63.21.]

Live Stock.

Corrie, F. E.—The Mineral Needs of Farm Stock. The Supply of Lime and Phosphate to Animals. (8 pp.) The Author, Star Cottage, Lingfield, Surrey, 1923, Free. [612.394.]

Rowlands, M. J.—Open-Air Pig Breeding. Scientific and Practical. (245 pp.) London: Vinton & Co., 1923, 7s. 6d. net. [63.64(02).]

Iowa Agricultural Experiment Station.—Bulletin 208:—Self-Feeders for Swine. (pp. 97-143.) Ames, 1922. [63.6: 69.]

Dairying and Food.

Leeds University and the Yorkshire Council for Agricultural Education.—Report 131:—Clean Milk and its Production. (7 pp.) Leeds, 1923. [614.32.]

Illinois Agricultural Experiment Station.—Bulletin 244:—The Feed Cost of Milk and Fat Production as Related to Yields. (pp. 551-573.) Urbana, 1923. [63.714.]

Illinois Agricultural Experiment Station.—Bulletin 241:—Comparative Expense of Mechanical and Hand Milking. (pp. 491-506.) Urbana, 1923. [63.713; 63.714.]

Food Investigation Board, Department of Scientific and Industrial Research.—Special Report 13:—Studies in Sweetened and Unsweetened (Evaporated) Condensed Milk. (103 pp.) London: H.M. Stationery Office, 1923, 4s. net. [63.715.]

Ministry of Health.—Reports on Public Health and Medical Subjects No. 17:—Notes on the Pasteurisation of Milk. (14 pp.) London: H.M. Stationery Office, 1923, 2d. net. [63.717.]

Poultry and Bees.

Powell-Owen, W.—Selecting the Layers.—Describing in Detail the Internal Mechanism of the Laying Hen and the "Powell-Owen" Score-Card System of Hand-grading. (330 pp.) Hampstead, London: Powell-Owen Poultry Publications, 1923, 10s. 6d. [63.65(02).]

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Betts, A. D.—Practical Bee Anatomy with notes on the Embryology, Metamorphoses and Physiology of the Honey Bee. (88 pp.) Benson, Oxon: Apis Club, 1923. [63.81.]

Economics.

Venn, J. A.—Foundations of Agricultural Economics. (412 pp.) Cambridge: University Press, 1923, 16s. net. [338.1(02); 63(09).]

Bensusan, S. L.—The Town versus the Countryside. (23 pp.) London: P. S. King, 1923, 6d. [338.1(04).]

Wood, L. S.—The Principles and Practice of Farm Valuations. 4th Edition. (326 pp) London: Estates Gazette, 1923, 12s. 6d. [63.191; 347(a).]

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Farm Stock-Taking, *J. M. Adams.* (Jour. Dept. Agr., Ireland, Feb., 1923, pp. 360-371.) [657.]

The Uses of Costing, *C. S. Orwin.* (Jour. Land Agents' Soc., Sept., 1923, pp. 435-446.) [657.]

Farm Profits and Farm Losses, *A. G. Ruston.* (Scottish Jour. Agr., July, 1923, pp. 287-296.) [63(42); 338.58.]

Basic Slag and Mineral Phosphates on Hill Pastures, *W. G. Smith* (Scottish Jour. Agr., July, 1923, pp. 253-267.) [63.33-16.]

The Efficiency of Ammonium Sulphate as a Fertiliser, *J. A. Prescott.* (Jour. Agr. Sci., July, 1923, pp. 333-339.) [63.1671.]

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Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W.1.

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OF THE
MINISTRY OF AGRICULTURE
Vol. XXX. No. 8.

NOVEMBER, 1923

NOTES FOR THE MONTH.

Distribution and Prices of Cereals, Flour and Bread.

THE Departmental Committee on Distribution and Prices of Agricultural Produce has issued its fourth Interim Report* dealing with cereals, flour and bread. This is the last section of the Committee's inquiries, and a final report, reviewing the general results of its investigations will be produced in due course. During the inquiry into cereals, flour and bread the Committee held 16 meetings and heard evidence from 40 witnesses, representative of farmers, corn-merchants, millers, bakers and consumers throughout Great Britain.

The report contains a systematic account of the marketing and distribution of home-produced wheat, barley, and oats, the milling and distribution of flour, and the cost of baking and distribution of bread. The expenses and profits of millers and bakers were investigated, and their reasonableness or otherwise is fully discussed.

The section of the report which will probably interest farmers most is that dealing with the successful efforts recently made to breed a wheat with the high yield of the typical English varieties, which would in addition command the prices paid for Canadian and some other imported wheats. Such a variety is now available to farmers in " Yeoman."

The Committee concludes by stating, " We have investigated the system of distributing cereal crops and found it to be, on the whole both simple and inexpensive. So far as the manufacture and sale of bread is concerned, we have shown that the time has come for many bakers to reduce their prices consequent on recent reductions in costs, notably in the price of flour."

" We have emphasised that, as the farmer cannot look for any immediate and material improvement in the price he obtains

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* The report can be obtained through any bookseller or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2. (Price 3s. net.)

(51463) P.6./B.4. 9,000. 11/23. M. & S.

for his wheat by alterations and economies in the established methods of production and distribution of either flour or bread, a steady and permanent improvement in prices is to be sought by enhancing the intrinsic commercial value of the wheat he grows. This he can do by concentrating on the production of newly evolved varieties of wheat of high milling quality. Indeed, up to the limits of available supply, there is even now no reason why consumers should not be supplied with a high-class all-English loaf if farmers will grow suitable wheats, if millers will manufacture the flour, if bakers will use it, and if all three combine to make the merits of this all-British product known to the public. The creation of an articulate demand is essential. The natural play of economic forces will determine the course events will take, but if for wheat of high-milling quality the farmer ultimately obtains the higher price to which he is or will be fully entitled, while, at the same time the improved varieties yield satisfactorily, wheat production in this country would receive much-needed encouragement."

* * * * * *

Distribution of Foot-and-Mouth Disease.

FARMERS in certain districts are uncomfortably aware of what is involved locally by an outbreak of foot-and-mouth disease, and all concerned would be highly gratified if the chief means of its distribution could be discovered. It is a simple matter perhaps to show that many neighbouring outbreaks have been due to contact in markets, or to the distribution of affected animals from a big market. It is quite another matter to determine the origin of many an initial outbreak which may have occurred on an isolated farm on which movement of stock has not taken place. For this reason the article by Sir Stewart Stockman and Miss Marjory Garnett at p. 681 is of special interest.

For some years past the Ministry's Chief Veterinary Officer has had under examination the possibility of the distribution of the virus of foot-and-mouth disease by birds, which it was considered might introduce the disease when migrating from other countries in which it is very prevalent. The authors have investigated the possible relationship between bird migration lines and the outbreaks of foot-and-mouth disease over the past twenty years, and they now detail their results. The problem was approached with an open mind, but the authors did not find it possible to establish a negative; while some factors are uncertain it seems that there are very clear relations, both as regards seasons and localities, between bird movements and initial outbreaks of foot-and-mouth disease.

It may be added that Sir Stewart Stockman is now carrying the investigation further, by seeking to determine by experimental evidence whether birds do actually convey the virus.

* * * * * *

The Farmer's Poultry.

THE article by Mr. J. W. Hurst in this issue (p. 715) draws attention to the opportunity which undoubtedly exists for British farmers to develop with profit a subsidiary branch of their operations. Before the War about 50 per cent. of the eggs imported into this country were produced in Russia. Practically none of these eggs were the product of specialised egg farms, but originated on the small holdings of the Russian peasantry. Even the large supplies which were imported from Denmark and Ireland before the War, and which still arrive in approximately the same quantities, are produced on general farms. In fact, in every poultry-producing country it may be said that by far the greater bulk of the poultry and eggs produced are the result of the poultry husbandry of the general farmer.

The United States of America, which supplies all the requirements in poultry produce of its population of 110 millions, maintains more than half its total poultry—amounting in all to over 370 million birds—on general farms in the corn belt, and increasing interest in poultry and egg production is being shown by the farmers in these districts. That is not to say that the general farmer in America is devoting more attention to poultry keeping from mere love of the work. On the contrary it is proverbial that in the past the general farmer has disliked poultry and has looked upon them with contempt. Sheer necessity, however, has driven him into active endeavour to take advantage of the opportunity for making the profits offered by keeping poultry on his farm. This is to some extent true of the English farmer.

The present opportunity offers a much wider scope for the development of poultry keeping in this country; but the opportunity is not likely to continue indefinitely. Farmers in countries all over the world are increasing their output of eggs and poultry, and their marketing organisations are in nearly every case endeavouring to secure a footing in the British market, which is the greatest importing market in the world for eggs and poultry. Competition from abroad is therefore likely to become keener; but the man in possession of a market always has an advantage over a newcomer, and if the English farmer produces and markets in proper condition, a first-grade English egg—which no foreign country can supply—he will not only obtain a benefit for himself in these days of agricultural depression, but will confer a benefit on the nation by reducing the sums paid abroad for imported food.

* * * * * *

Agriculture at the British Empire Exhibition.

A GOVERNMENT Pavilion is being erected at the British Empire Exhibition at Wembley in which will be shown various Government activities of interest to the Empire. Agriculture will be included, and exhibits are being prepared by various Research Institutes throughout the country in co-operation with the Ministry and the Board of Agriculture for Scotland. The object will be to show, in an attractive and popular manner, the practical application of research to agriculture, and the display should be of the greatest value and interest to agriculturists.

It is proposed also to show various phases of agricultural activities on the cinematograph, and it is hoped to arrange for a series of lectures by eminent authorities. The research exhibit will be explained by guide lecturers. In addition to this review of the assistance given by the Government to agriculture, in the Government Pavilion, a model working dairy is being erected by the National Milk Publicity Council which will be equipped with all the latest improvements in modern dairy appliances.

* * * * * *

The Improvement of Live Stock.

IN the October issue of this *Journal* was published the Ministry's Report for the year ending 31st March, 1923, on the schemes for the improvement of live stock and light horse breeding. The report shows that a good deal has been accomplished in this direction within the limited scope allowed by the economic stricture of the period.

It cannot be too often stated, or too fully realised how important a part breeding of live stock must play in the revival of the agricultural industry of the country. It has been for many years the proud boast of the British breeder that his pedigree live stock had a world-wide reputation for its excellence, and before the War there was a wide demand from the overseas dominions and foreign countries for animals from the pedigree herds, flocks and studs of this country. This trade was seriously damaged by the War and subsequent developments, and now that it is reviving with the general demand for fresh stock, every effort is required to maintain and enhance the pre-eminence of British live stock in the world market.

The importance of good breeding too in its relation to the food supply and to the military requirements of the country has been emphasised by the events of the last decade, and these considerations should make the progress shown in the Ministry's report on its improvement schemes of special interest.

* * * * * *

Customs Duty on Imported Malting Barley.

THE Treasury has appointed a Committee to consider the various methods of levying a Customs Duty upon imported malting barley, and to report what, in their opinion, is the most convenient form of duty. The Committee is constituted as follows:—

Captain M. Falcon, M.P. (Chairman).
Mr. George Bull, C.B.E., representing the National Association of Corn and Agricultural Merchants.
Mr. H. D. Cherry-Downes, representing the Maltsters' Association of Great Britain.
Mr. H. Fountain, C.B., representing the Board of Trade.
Mr. Harry German } representing the National Farmers' Union.
Mr. Cleveland Fyfe }
Mr. J. Holman, representing the National Federation of Corn Trade Associations.
Mr. W. H. Pascoe, representing the Customs and Excise Department.
Mr. Hugh F. Paul.
Mr. W. H. Ross, representing the Whisky Association.
Major E. A. Ruggles-Brise, M.P.
Mr. R. J. Thompson, C.B., O.B.E., representing the Ministry of Agriculture and Fisheries.
Mr. S. R. Wells, M.P., representing the Brewers' Society.
Sir David Wilson, Bart.

Mr. E. S. Bertenshaw, of the Customs and Excise Department, and Mr. R. Ross, of the Ministry of Agriculture and Fisheries, will act as Joint Secretaries to the Committee.

* * * * * *

National Rat Week.

IN the October issue of the *Journal* attention was drawn to the National Rat Week which has been fixed this year for the period 5th to 10th November. This is an opportune time for farmers and others to make war on rats and mice with the greatest possible chance of success, and eventually to take collective action as enjoined by the Rats and Mice (Destruction) Act, 1919. Application for advice should be made to the local authority responsible for the administration of the Act, or to the Ministry of Agriculture and Fisheries. In those areas where systematic destruction has been instituted, a great reduction in the number of these pests has taken place. Rats and mice serve no useful purpose in the economy of the farm, but only consume and destroy large quantities of food stuffs. Their eradication is a direct boon to the occupiers of premises in which they have taken up their abode.

* * * * * *

The Agricultural Index Number.

A FURTHER rise was recorded in September in the average prices of agricultural produce, the general index number advancing from 54 per cent. above pre-war in August to 56 per cent. above in September. There has thus been a rise of 5 points from the minimum of June, and although the prices of different commodities vary appreciably, the general level is now practically the same as a year ago. The increase in September was due in the main to fruit and barley, the index figure for the former advancing sharply owing to the very high prices of plums and pears as a result of the poor crops. Small fruits which were on the market last month were relatively much cheaper than plums and pears.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	54
September	202	116	57	56
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

The average price of wheat during September was only 19 per cent. above pre-war, compared with 23 per cent. above in September, 1922, and there was a sharp decline as compared with August, 1923, during the early weeks of which most of the wheat on the market was of last year's crop. With more barley of malting quality on sale, prices showed a sharp rise on the month, and at 30 per cent. above 1911-13, were higher than a year ago. Oats declined by about 4d. per cwt., but as this reduction was relatively the same as in pre-war days, the index number remains unchanged at 30 per cent. above 1911-13. The prices of grain continue at a lower level than those of other kinds of agricultural produce, though hay at only 32 per cent. above pre-war is relatively little dearer than barley or oats. Hay prices showed very little change on the month, but usually these harden in September, so that the index figure declined by 2 points.

The average price of main crop potatoes during September was 75 per cent. above pre-war, whereas in September last year they were down to the pre-war level. There was, however, a pronounced decline during the latter half of the month owing to the markets being over-supplied, and in the week ending 26th September potatoes averaged about 60 per cent. above 1911-13.

Fat cattle were 2d. per stone cheaper than in August, but as prices have declined during the last two months at relatively the same rate as before the war, the index number has remained practically unchanged since July. The prices of fat sheep have been very steady since mid-August, but over the whole of September averaged ¼d. per lb. less than in the previous month. The index number declined from 76 to 72 per cent. above pre-war, but fat sheep are still relatively much dearer than fat cattle or pigs. The rise in the prices of fat pigs which took place during August has not continued, though there has been no falling away, so that the average for September is about 4d. per stone higher than for August, and the index number shows a rise of 3 points to 55 per cent. above September, 1911-13.

Dairy cows usually advance in value in the late summer and autumn, but the increase of about 15s. per head in September was relatively rather greater than usual. Although there was some improvement in the demand for store cattle towards the end of the month trade was slack on the whole, and the index number shows a slight decline. Store sheep have, however, continued in good demand, and the increase of 2s. per head on the month brings this class of stock to more than double the pre-war level. Store pigs show a further decline and average 95 per cent. above 1911-13, as compared with 102 per cent. above in August. All classes of live stock except store sheep are cheaper than in September, 1922.

The prices received by farmers for milk remained unchanged in September at 67 per cent. above 1911-13, but the rise in the price of butter as compared with August was rather sharper than usual at this season, and the index number moved from 48 to 56 per cent. above pre-war. Cheese also became dearer and rose to 74 per cent. above 1911-13. Cheese was 24s. per cwt. dearer than in September, 1922, whilst butter was 2¾d. per lb. cheaper.

As is usual at this time of the year eggs showed an appreciable rise, being nearly 3d. per dozen dearer than in August, the index number increasing from 68 to 75 per cent. above pre-war.

* * * * * *

Conciliation Committees in Agriculture.

THE Cumberland and Westmorland Committee have extended their current agreement to cover the hiring period 11th November, 1923, to 7th June, 1924. The terms are as follows:—

Skilled male workers aged 21 and over	37/-	For a week of customary hours (defined as 63).
Skilled male workers aged 20 and under 21	32/-	
Skilled male workers aged 18 to 20	28/-	
Skilled male workers aged 16 to 18	23/-	

Other adult male workers 30/- for a week of 54 hours in summer and 48 in winter.

Female workers aged 16 and over, 5d. per hour.

Provision is also made for overtime to be paid for at the rate of 8d. per hour and for the value of board and lodging to be computed at 15s. per week for all male workers of 16 years of age and over.

The agreement of the Devonshire Committee, which was due to expire at the end of September, has been extended to 5th January, 1924, with the understanding that unless either side asks for re-consideration it will continue to Lady-day. The terms provide for the payment to adult male workers at the rate of 30s. for a week of 51 hours, with overtime at 8d. per hour on weekdays and 10d. per hour on Sundays Rates of wages for male workers under 21 years of age and the values at which the provision of board and lodging may be reckoned are also included in the agreement.

The Merioneth and Montgomery Committee have also decided to maintain wages at the present level, the current agreement having been extended to 30th April, 1924. The rates are 31s. for a guaranteed week of 60 hours for stockmen (the guaranteed weekly wage for these workers being a new feature of the agreement), 28s. for a week of 52 hours for other adult male workers and proportionate rates for male workers under 21 years of age.

* * * * * *

BIRD MIGRATION AND THE INTRODUCTION OF FOOT-AND-MOUTH DISEASE.

SIR S. STOCKMAN,
Chief Veterinary Officer, Ministry of Agriculture and Fisheries,
and
MISS MARJORY GARNETT.

IN an article entitled " The Question of Invasion " prepared by the senior author (S. S.) for his Annual Report in 1919* he discussed the problem of invasion of this country by foot-and-mouth disease in the light of what seemed to emerge from studying the outbreaks over a period of 20 years. Since then further outbreaks have been considered (1919-1921) but, although these necessarily increase the number examined, the alteration in the incidence of locality is negligible, and no entirely new facts of importance have come to light By examining the recorded stories of outbreaks, it was found possible to classify them under two important heads :—(*a*) Initial outbreaks of invasion; (*b*) Outbreaks of ramification from the former.

Those in (*b*) require no further explanation for their classification.

As regards those placed in (*a*), they are those which arose after the country had been free from the disease for more or less long periods—months or years—in excess of what there is reason to believe represents the usual viability of the virus outside the body, and those arising simultaneously in parts of the country very remote from each other and having no possible connection, except perhaps through the same agency, whatever it be, whereby the virus is carried long distances and in certain directions. This apparently is the same problem as that of invasion from without the country. In this particular connection it has to be noted :—

(1) That the entry into Great Britain of ruminants and swine was totally forbidden, as was also the importation of straw and hay from any infected country; yet the outbreaks of invasion continued.

(2) That the outbreaks were dealt with by slaughter, and the question of recovered carriers of infection did not therefore arise.

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* *Annual Report of Proceedings under the Diseases of Animals Acts, Ministry of Agriculture;* see also *Journal of Comparative Pathology and Therapeutics,*" Vol. XXXIII, 1920.

(3) That all infected premises, after slaughter of the animals, were disinfected both chemically and by prolonged isolation as regards fresh stock entering thereon, and were never attacked more than once.

Possible Carriers of Infection.—Feeding stuffs and packing materials imported from abroad, and human beings who had come from foreign countries, fell under suspicion as the mechanical carriers of infection in general, for the evidence is definite in connection with the outbreaks of ramification that infection can be carried by human beings, by food stuffs, and by straw. Although on inquiry it very occasionally transpired that one or other of these possible agencies might have been the origin of an initial outbreak, in the vast majority of cases there was no such evidence, and in many cases the initial outbreaks arose on more or less isolated farms, where nothing but home-grown material had been used; at which no strangers had visited; and off which the residents and attendants had not been for some considerable time before the outbreak. Additional and strong evidence against imported materials of commerce or human beings from abroad being generally responsible for the introduction of infection was brought out from the fact that the distribution of the initial outbreaks did not follow the lines of distribution of the imported food stuffs, etc. Human beings, and imported food stuffs, go to all parts of the country, but it transpired, in fact, that the greater part of the United Kingdom had escaped outbreaks of initial invasion, and that these, over a period of 22 years, had arisen almost entirely in more or less definite areas, some of these, again, being much more favoured than the others. The same premises in these areas, moreover, were practically never stricken a second time, a fact which finally demolished the improbable suggestion that infection might have lain latent from a previous outbreak. The distribution of these initial outbreaks of invasion was sufficiently definite to justify the conclusion that it did not arise from purely fortuitous circumstances. As is well known, the invasions of this country occur during the waves of prevalence of foot-and-mouth disease on the Continent of Europe.

Human beings, imported animals, and food stuffs—the ordinary communication between farm stock and the outer world, as it were—having been eliminated as agencies of conveyance in general, it seemed worth while examining the possibility of the virus being air-borne, particularly through the agency of birds. It is worthy of mention here that publication of the article previously referred to (Annual Report, 1919) has aroused special interest amongst the inspectorate staff of the Ministry of Agriculture dealing with outbreaks in the field, and some of them in their reports have been able to furnish actual and personal observations, which tend to show that in connection with outbreaks of ramification, at least—outbreaks arising, say, up to a few miles apart from each other—birds are responsible for carrying infection. The reports also contain the information that at the time of certain initial outbreaks flocks of birds (place of origin unknown) had been observed in the neighbourhood, and even on the farm where infection arose.

In outbreaks of ramification birds (chiefly starlings, rooks, crows, wood pigeons and gulls) have been seen to feed at the troughs used by affected animals at pasture, and to fly to other farms nearby, where disease subsequently broke out, notwithstanding there had been no other known communication between the premises.

In considering the way in which birds might carry infection, three possibilities suggested themselves:—

(1) The birds might contract an attack of the disease in some form. Birds in general are known to be very insusceptible to the disease, but there are recorded cases which seem to show that this species-insusceptibility is not absolute. Therefore, given only a few susceptible birds affected with the disease, amongst the millions which migrate to this country, this explanation would not outrage the observations as to incidence.

(2) That by frequenting infected pastures, etc., the birds might contaminate their feet or plumage with the virus, and afterwards carry it over long distances to other pastures, etc This is definitely possible, since we know that the virus, so long as it can find the conditions for maintaining its viability, can be carried on straw, hay, clothes, etc., and feathers might warrantably be included.

(3) That the virus might be swallowed (in food or water) by birds, pass through their intestines uninjured, and afterwards be excreted in their droppings at places remote from where the virus was picked up.

The object of this article is to deal with the circumstantial evidence, without, for the moment, dipping into the experimental evidence, such as it is at present. It is a remarkable fact, however, that initial outbreaks of invasion practically never arise amongst animals which are completely housed, and the ramifications from initial outbreaks are infinitely more numerous if invasion occurs at seasons when most of the animals are at pasture. The spread of the disease from premises to premises, moreover, can be checked to a remarkable extent if owners can be prevailed upon to keep their animals indoors, which may, of course, at times be impossible, for obvious reasons.

A map of the initial outbreaks—80 in number—over a period of 22 years, was filled in (*see* Map 1, which is a summary, as it were, of the principal map). A chart was also constructed showing the monthly incidence of the initial outbreaks in each year of the 22; the totals are summarised in Table I.

It is upon the above records and circumstances that the junior author* has brought to bear her studies on birds and their movements, a subject which has occupied her attention for many years. To prevent misunderstanding, however, it should be explained that, both the authors being aware that a positive was practically impossible to prove under the circumstances, the object of the inquiry in the first instance was to see whether the question could not be definitely settled by proving a negative, that is to say, by finding the circumstances of invasion so out of accord with those of bird movements that the theory could not be entertained. This it is hoped will relieve the authors of any imputation of a desire to engage in special pleading.

Bird Migrations.—A closer examination is made in this paper of the initial outbreaks of foot-and-mouth disease for the last 22 years in connection with bird migration, and particularly the migrations of those birds which frequent pastureland, as these are the most likely to carry the virus of the disease, if it can be so carried.

Foot-and-mouth disease occurs very little in the countries north of Denmark, and if birds bring it to England from the Continent, they must come from countries to the east, south-east and south. One would expect therefore, to find most of the outbreaks in the south-east part of England. This is actually so; for if a line is drawn from the Wash to the Bristol Channel, it will be found that in the district north and west there have been 27 initial outbreaks, and in the district south

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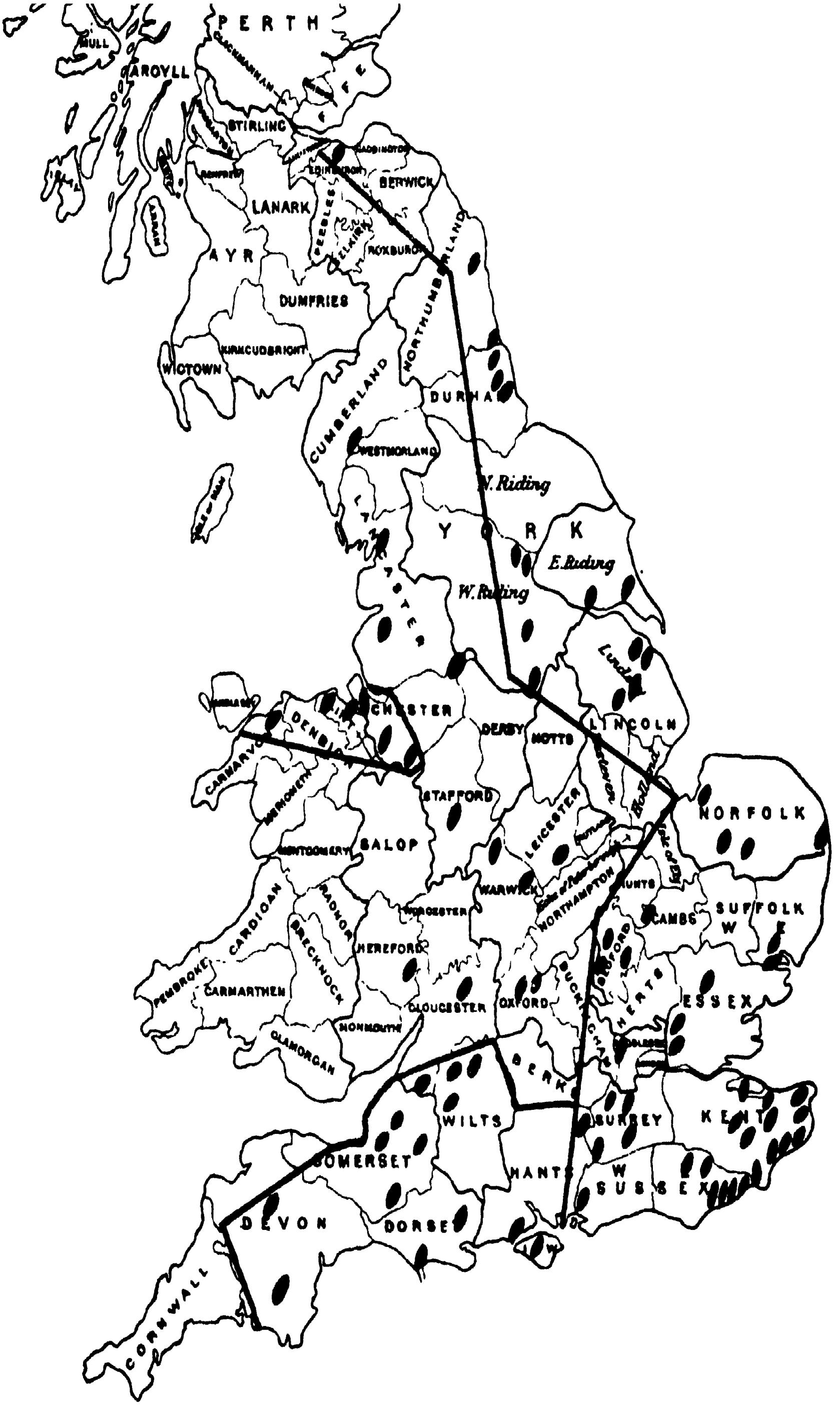
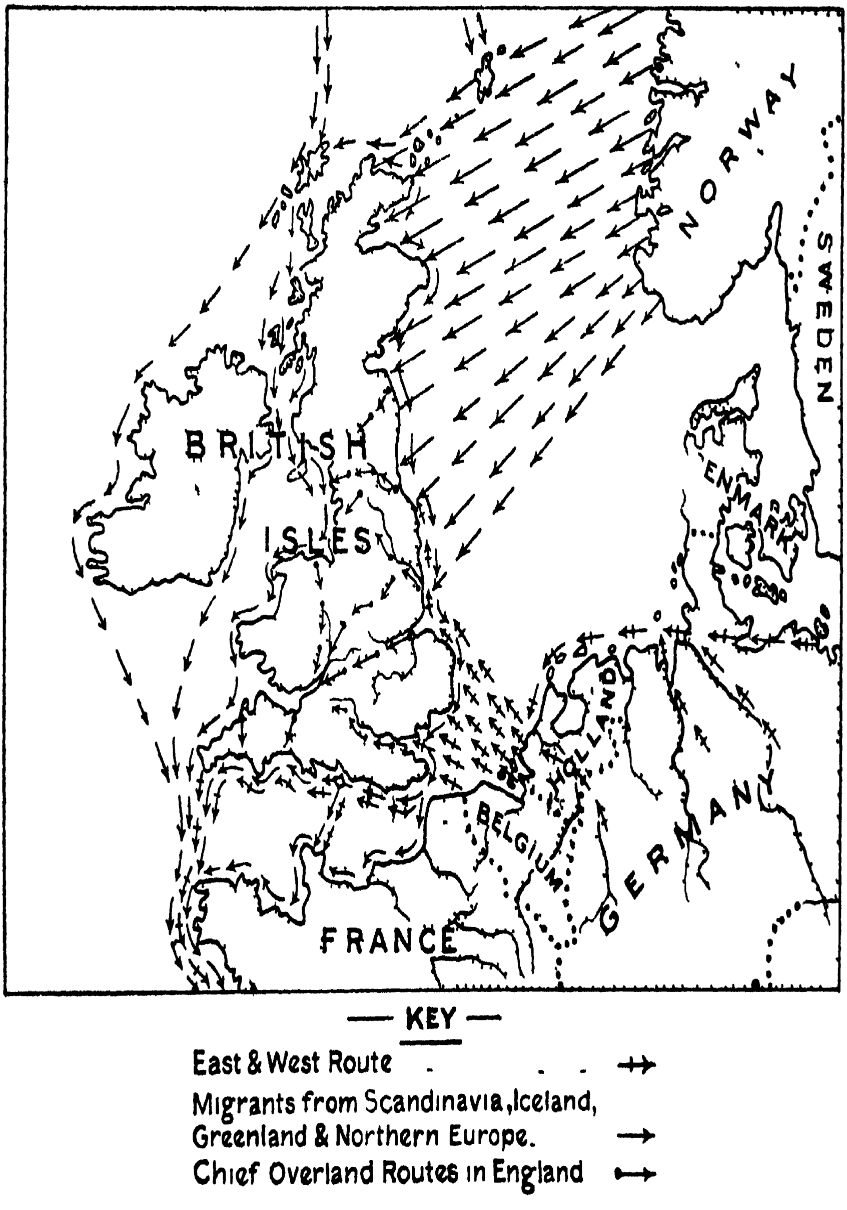
* Miss Garnett is almost entirely responsible for the work relating to bird movements in particular.



Map 1.—Showing Initial Outbreaks of Foot-and-Mouth Disease during 22 years (1900-1921).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Migrants from Scandinavia, Iceland, Greenland & Northern Europe.
Chief Overland Routes in England

MAP 2—Diagrammatic Map of Bird Migration Routes (Autumn) and east 52, or nearly twice as many. Of these 52, 36 have occurred east of a line drawn north and south through the Isle of Wight.

There are two great tides of bird migration which flow through these islands; (*a*) the well-known movement roughly from north and north-east to south in autumn and back in spring, and (*b*) the less known, but not less important movement from east to west in autumn and west to east in spring.

In the autumn migration on the "north and south route" great numbers of birds arrive on our north-east coast from Scandinavia to continue their journey southwards, and birds from Iceland, Greenland, and northern Europe, pass down both the east and west coasts. This migration need not be taken into account, because the birds following these lines do not come from countries frequently infected.

There remain, then, two regular annual migrations of birds from the south and east:—

(1) The spring migration from the south of birds returning to summer quarters in the British Isles, or passing through on their way further north. This movement begins about mid-February and lasts through March, April, May and sometimes even into June.

(2) The "east to west" autumn migration, when immense numbers of birds arrive on our east and south-east coasts after crossing the North Sea from the shores of Belgium and Holland. This migration starts in mid-September, and lasts throughout October and the first half of November. It may, however, start again any time during the winter when there is severe weather on the Continent of Europe.

The following Table shows the total number of initial outbreaks of foot-and-mouth disease for each month of the year over the whole period 1900-1921, and also the number of years during the same period in which outbreaks have occurred in each month.

TABLE I.

	Jan.	Feb.	Mar.	Apr	May	June	July	Aug	Sept	Oct.	Nov.	Dec.
Number of Outbreaks..	14	5	4	4	2	2	9	3	8	8	8	12
Number of years in which outbreaks have occurred	4	4	4	4	1 or 2*	2	5	3	6	5	6	6

* 1 doubtful case.

The second set of figures shows pretty clearly in which months the outbreaks are of most *regular* occurrence, and serves as a useful check on the first set, though the first set would be influenced more or less by the opportunities for infection of a large or small number of birds.

From this Table it is clear that by far the greater number (rather more than 64 per cent.) of initial outbreaks have occurred in the months from September to January; that is in the months when birds are coming to England by the "east to west" route, either on normal migration, or (in December and January) owing to hard weather on the Continent. The incidence is also annually high in these months.

From February to May, the months of the spring migration, there are far fewer initial outbreaks, and they are of less regular occurrence than in autumn and winter.

The three summer months, June, July and August, are of peculiar interest because of the large number of outbreaks in July. Migration during the summer is not altogether at a standstill; belated spring migrants are still passing north in June, and in July and August there is probably a little east to west migration. Until, however, more is known definitely of the movements of birds at this season, it is difficult to say whether they can account satisfactorily for the *number and regularity of these outbreaks* in July, and the incidence in this month must for the present be accepted as unfavourable to the theory of birds as carriers of infection over long distances.

So far as can be seen from a contour map, however, the localities of the outbreaks of foot-and-mouth disease favour, on the whole, the idea that the virus may have been introduced by birds. The majority are not exactly on the coast; but migrants, on arrival, unless very exhausted, usually fly inland for some distance before alighting; and many of the more inland outbreaks are in river valleys, which are always great highways for birds. Even when there is an isolated outbreak well into the country (like that near Ripon on 16th July, 1910) there is always the possibility that just before and after that date the bird or birds did not alight in any place where they could have come in contact with cattle, etc., or that cattle did not pick up the virus although deposited.

A striking feature about the outbreaks on the coast is that, unlike those more inland, most of them are near towns of some size. For instance, out of 10 outbreaks on the coast in Kent, 2 are near Rye, 2 near Folkestone, 1 near Hastings, 1 near Deal and 1 near Margate. There is probably some reason for this, and so far as birds are concerned, the most likely explanation is that these outbreaks have been caused by gulls, which are attracted to places where fishing goes on by the offal that is thrown out.

Species of Birds likely to be Carriers.—Before going into more detail with regard to the individual outbreaks, it will be useful to review briefly the birds which, from their habits, would be most likely to carry and spread the disease. These must be mainly birds which (*a*) frequent pasture fields, and (*b*) are migrants, coming to this country from places to the east and south (infected countries), especially birds using the "east and west" route in autumn and winter.

Immense numbers of ROOKS (*Corvus frugilegus*), JACKDAWS (*Colœus monedula*), STARLINGS (*Sturnus vulgaris*) and SKYLARKS (*Alauda arvensis*) come in from central Europe in autumn, travelling from east to west across northern Continental Europe, and down the river valleys to the coasts of Belgium and Holland, whence they cross the North Sea to our east and south-east coasts. In spring, birds of the same species which have wintered in southern Europe, arrive on the south coast, and also on the east coast between Kent and Norfolk. All these birds frequent pastureland. Starlings in particular delight in feeding close to animals at pasture. They are also attracted to feeding troughs in winter.

WAGTAILS, particularly PIED WAGTAILS (*Motacilla alba lugubris*), are also fond of feeding near animals at pasture, probably to pick up the insects they disturb in the grass. These birds do not use the east and west route, but Yellow (*Motacilla flava*), White (*Motacilla alba alba*) and some Pied Wagtails come in from the south in spring.

There are a few records of HERONS arriving on the east coast in September, and they are birds which sometimes frequent marshy pastures and those bordering rivers and ponds.

GEESE come in autumn from the far north (which is not infected), but some which have wintered on the Continent pass through in spring on their return journey north, and both geese and ducks come in great numbers to the east coast in hard winters, when the marshes of the Baltic and the Holland coast are frozen. The grey geese feed regularly in the fields and marshes at night, but usually near enough to the sea or to some estuary to return there to rest during the day.

Of DUCKS the Mallard (*Anas platyrhynchus*) (Wild Duck) and Teal (*Anas crecca*) are perhaps the most likely to come in contact with cattle. Most of the mallard wintering in this country come from the north in autumn, but in hard winters many come from the east and south-east also. At that time of year they often spend the day in large flocks on the sea, or on mud flats, or sheets of open water, flighting in at night to feed in the marshes and fields.

Some of our teal (as well as some mallard) winter on the Continent, and might bring the disease back with them in spring. They would only be likely to affect cattle in marshy fields or near drinking pools. Several initial outbreaks have arisen on such pastures.

A great many WOODPIGEONS (*Columba palumbus*) come to this country by the east and west route. They do not regularly feed in pasture lands, but may visit the feeding troughs.

There are three common WADERS which frequent pasture fields in large flocks. The Lapwing (*Vanellus vanellus*) (Peewit or Green Plover) and the Golden Plover (*Charadrius apricarius*) are found both inland and on the coast, the former being extremely common and the latter fairly well distributed in winter. Immense numbers of lapwings, as well as a few golden plovers, come here by the " east to west " route in autumn and winter. These birds might also bring the disease when migrating north in spring.

The third wader, the Curlew (*Numenius arquata*), is much more of a shore bird in winter than the other two, especially in cold weather, though many resort to inland pastures to feed or to rest at high tide. Some curlews come in by the " east to west " route, and birds wintering further south pass through England in spring, when they go inland to their nesting places, and they also follow some of the overland migration routes on their way further north.

The Redshank (*Tringa totanus*) and Common Snipe (*Capella gallinago*) ought perhaps to be included in the list of waders; both, though present in England all the year round, are migratory to some extent, and both are fond of marshy pastures.

There are other waders, some of them typical shore birds, which might bring the disease when migrating overland or along our coasts, especially when they return northwards in spring and early summer; but none are of great importance in the present connection, though it is possible that even rare visitors (or vagrants) might cause isolated cases.

GULLS are especially interesting because of the large numbers of immature and non-breeding birds which have nothing to prevent them from wandering about at all seasons. Of the five common kinds, four—the Greater Black-backed Gull (*Larus* *marinius*), Lesser Black-backed Gull (*L. fuscus*), Herring Gull (*L. argentatus*), and Common Gull (*L. canus*)—take from three to five years to become adult, and the Black-headed Gull (*L. ridibundus*) does not usually breed until two years old. These gulls vary individually in numbers at different places and different seasons, and except the great black-backed, are by no means confined to the coast. The two smaller kinds (black-headed gull and common gull) feed to a large extent on earthworms and grubs, following the plough or getting them from pasture fields. All gulls are, however, omnivorous, fishing when inland in rivers and ponds and feeding on garbage heaps. Several initial outbreaks have arisen near garbage heaps from slaughterhouses and fish factories. Gulls often rest in pasture fields even when not feeding there.

Not much is known definitely about the migrations of gulls. There is a general movement south in autumn, and north in spring. During the herring season on the Norfolk coast (*i.e.* in autumn), large numbers of great black-backed gulls and herring gulls congregate there, and it is almost certain that some immigration of gulls takes place at that time from the coasts of Holland and Belgium.

Besides these regular migrations, gulls are often on the move; when going from place to place they prefer to fly against the wind, and it is impossible to say how far they may go *in* search of food. The summer wanderings of immature and non-breeding birds might possibly account for some of the July outbreaks, which occur when there is practically no regular migration.

A closer analysis of the migratory movements of birds in relation to the seasonal and local incidence of the outbreaks of invasion (initial) is attempted in the following paragraphs.

Spring Migration (*see* Map 3, February, March, April and May).—Birds returning in spring to the British Isles to breed, or on their way further north, either cross the Channel direct to the south coast, and make their way north by inland routes, or follow up the east and west coasts. Many of them pass inland up the river valleys on their way to their nesting places. Those which have come up the west coast of Europe and are bound for Scandinavia and northern Europe, may cross the Channel via the Scilly Isles and then continue north-eastwards along the south coast of England, or turn northwards up the west coast for some distance before crossing over to the east by one or other of the overland routes. The general tendency at this season is from west to east over England as well as from south to north.

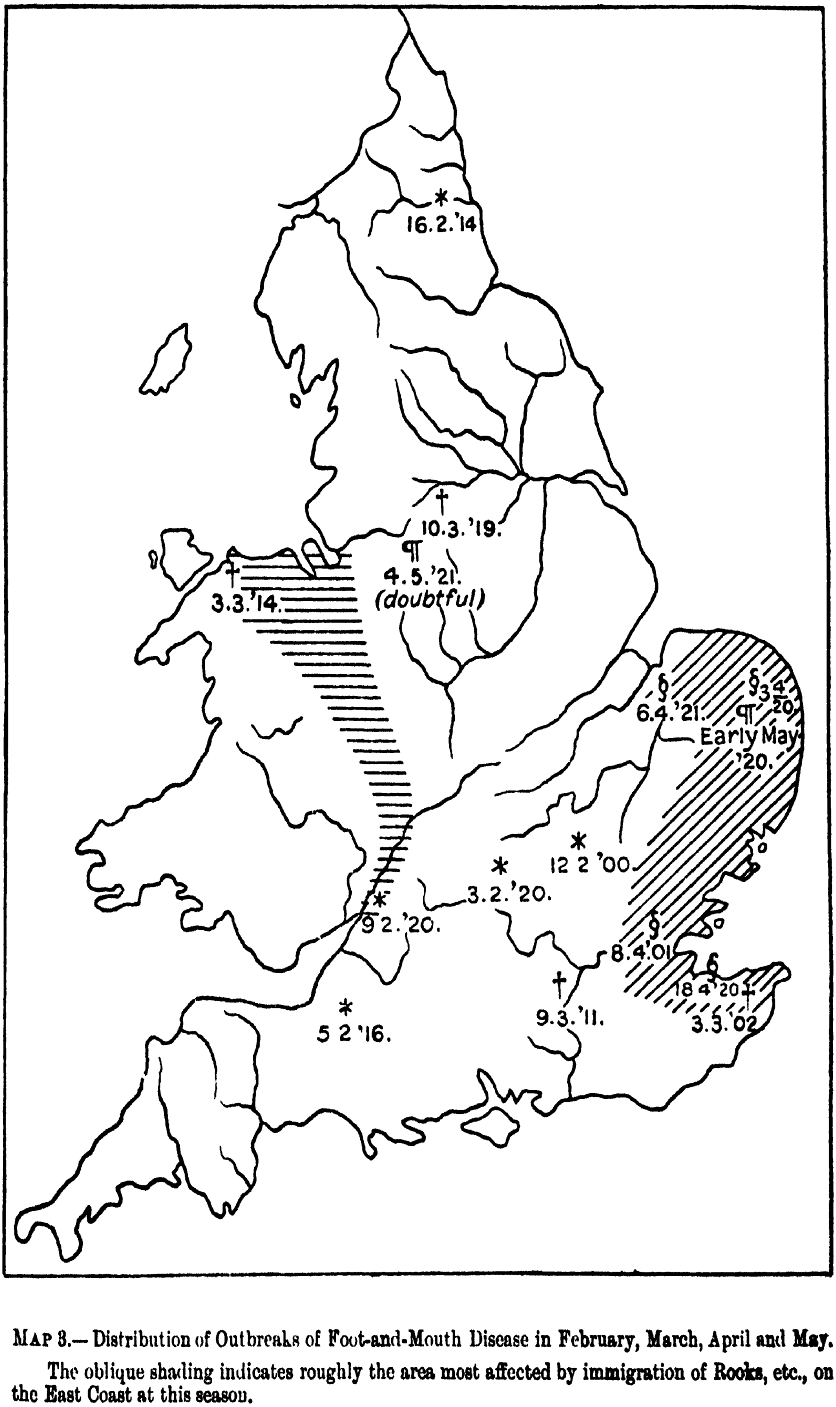
This migration does not start till mid-February (W. Eagle Clarke gives 11th February as the earliest date for arrivals on the south coast). The February outbreaks are all early in the month. This, however, would not necessarily exclude birds as carriers since earlier movements might take place at the tail-end of winter, and as weather movements. Nevertheless, it would be very curious if the weather migrants carried the disease in early February and the regular migrants did not do so later in the month, but neither spring immigration nor spring invasions are to be regarded as confined to February: the incidence is high in March and April, only falling in May and June.

It must be borne in mind that all the dates here mentioned, and those on the maps, are the dates of the actual appearance of the disease, and that from 5 to 10 days or more must be allowed for the virus to be picked up and for the period of incubation in the animal. This might easily take early February outbreaks back to January and winter movements, and so on for other dates.

South of the Wash there are March outbreaks in Kent and Surrey, April ones in Kent, Essex and Norfolk, and one May outbreak in Norfolk. These might be accounted for by the south to north migration of birds which have come directly across the Channel to the south coast: or the outbreaks in Kent, Essex and Surrey might equally have been caused by birds which had entered the country by way of the Thames estuary.

Either way the absence of outbreaks in the west of England and in South Wales is noteworthy, and if it means anything, points to infection having come from south-east rather than from due south. The idea that this may indeed be so receives some support from the fact that, according to W. Eagle Clarke (*Studies in Bird Migration*), "during late February, throughout March, and sometimes the first half of April, considerable numbers of rooks, occasionally accompanied by daws, starlings and skylarks arrive during the day-time on the south-east coast of England between Kent and Norfolk." These birds arrive from the east and south, and must be almost the only birds following the east and west route in *that direction* in spring.

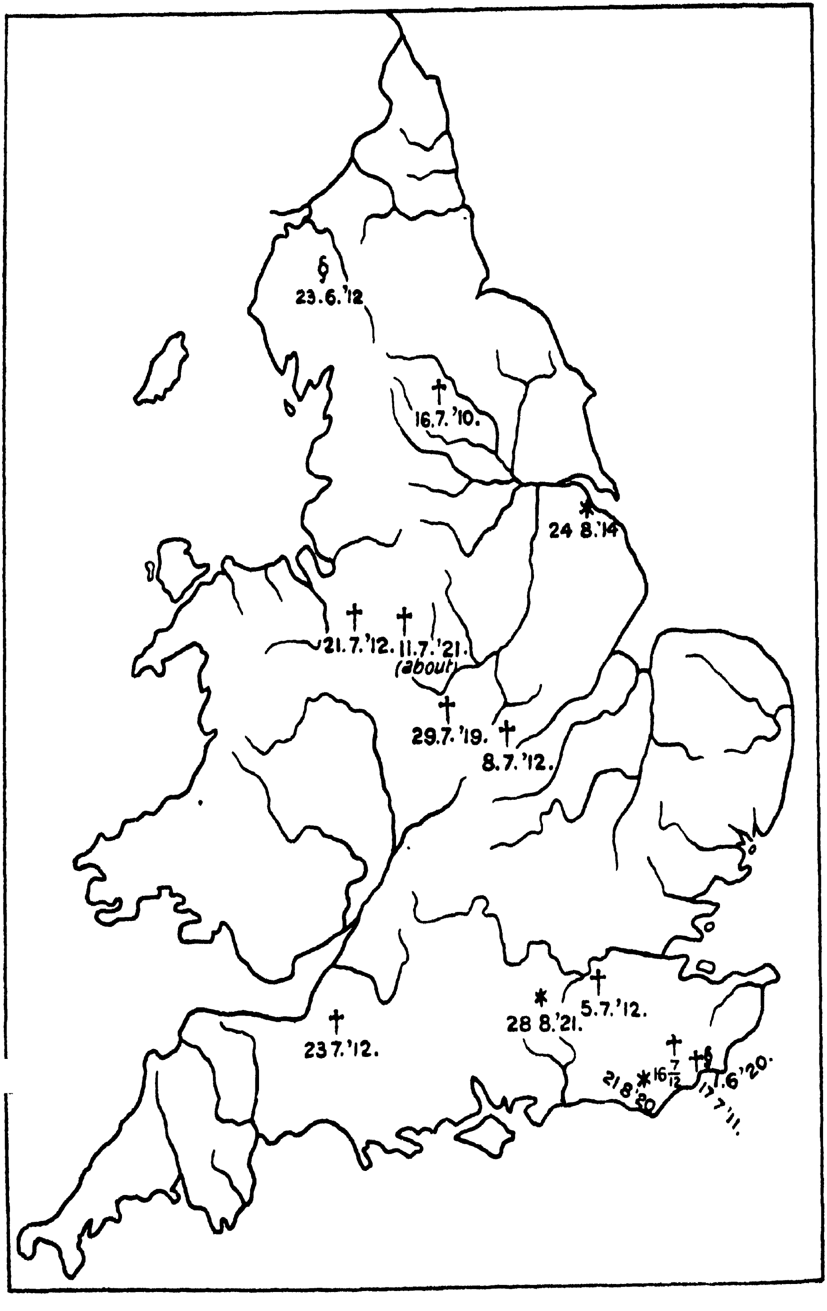
The March outbreak in Yorkshire might have been due to birds which had come up the east coast and followed up the river valleys from the mouth of the Humber.



MAP 3.— Distribution of Outbreaks of Foot-and-Mouth Disease in February, March, April and May.

The oblique shading indicates roughly the area most affected by immigration of Rooks, etc., on the East Coast at this season.

The horizontal shading shows the route followed by Gulls from the Severn to North Wales and Lancashire.



MAP 4. –Distribution of Outbreaks of Foot-and-Mouth Disease in June, July and August.

The March outbreak in North Wales would not appear very difficult to account for at first glance on the theory of birds being carriers. There is a well-known migration of gulls in autumn from the Dee estuary across the Ellesmere district of Shropshire and down the Severn valley to the Bristol Channel, and in spring there is a rather less marked return movement north along this route, some of the birds crossing the hills of north-east Wales, which would bring them out in the Rhyl and Conway valleys. This route is followed by black-headed, herring, and lesser black-backed gulls, and except for the first they do not often alight on the way. The March outbreak (Denbigh) would fit in well with this spring movement.* There have, however, been two other outbreaks along the same coast, neither of them anywhere near the time of the spring migration. These will be referred to later.

Summer Migration (Map 4, June, July and August).—In June some birds on passage to the north continue to cross our shores: and in July a few waders certainly arrive, mostly non-breeding birds and those that have finished nesting early. Some of these have probably come to us from the south-east (*e.g.* Ruffs in Kent). Most of the birds of which records are to be found, however, are of the rarer kinds, and as the July outbreaks have been, comparatively speaking, numerous, and have occurred in five different years, which shows them to be almost as regular as the winter ones, fortuitous migrants can hardly be accepted as having introduced the virus in July

There are a few birds which from their habits are to some extent open to suspicion, though there is little or no positive evidence of their coming from the Continent at this season.

Young starlings, both here and on the Continent, flock together and begin to move about as soon as they are fledged (*i.e.* about the middle of June). From 20th June onwards great numbers migrate from east to west across Heligoland, and there is some evidence that they have once or twice arrived on the east coast of England about the end of the month. It would seem, however, very exceptional for this migration to reach our shores.

Some lapwings are in flocks as early as the middle of June, and the fact that our own breeding birds are moving down to the coast and sometimes visiting outlying islands and lightships in late June and in July, makes it possible that some immigration might take place without attracting notice.

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* Given outbreaks in England in the northern or southern limits of this track, infection might be conveyed from north to south or vice versa. It is a fact that outbreaks on the Lancashire coast have been followed by others of quite obscure origin on the south-west coast.

Young herons (*Ardea cinerea*) on the Continent have been known to make very long journeys before the end of June; and while but little is known definitely of their migrations it is certain that there is a little immigration by the east and west route in autumn; as with the lapwings, the arrival of a few in late summer would be difficult to observe, because the home-bred birds frequent the shore at that season.

If birds have carried the virus for these July outbreaks, movement of gulls would also be a possible explanation. There are always a lot of young and some old, non-breeding birds round the coast in summer; they wander inland almost anywhere, following up the river valleys, visiting ponds and reservoirs, and any fields where they can find food. Their numbers might easily be increased by arrivals from the Continent without attracting notice, especially in summer when our own breeding birds are beginning to move about.

The distribution of these outbreaks particularly arouses curiosity; 5 out of 9 in July are north of the Wash to Severn line, while in all the other months the majority of the outbreaks are south of that line.

In most of the cases north of the Wash, it looks as if the disease had been brought up the Humber and dispersed along its tributaries into the surrounding country, or else had been brought in by the Wash and carried across England in a north-westerly direction; this might also apply to the outbreak in Cumberland in June, 1912. The July outbreaks south of the Wash might have been caused by birds which had entered either by the south coast or up the Thames valley.

The outbreaks on the coast in Kent near Rye in July, 1920, and June, 1911, by their position close to a fishing town, at once suggest gulls, possibly from the northern coast of France.

Autumn Migration (Map 5, September, October, November).—In autumn, besides the birds which stream down our coasts from the north, and those which cross the North Sea from Scandinavia and arrive on the east coast of Scotland and the north-east coast of England (these come from clean countries), an immense number comes to us from the east and south-east across the southern portion of the North Sea.

The centre of this immigration (from east and south-east) is on the Essex coast and the mouth of the Thames, and it extends from Dungeness in Kent as far north as Lincolnshire. The direction from which the birds come is due east on the

Essex coast and mouth of the Thames, and south-east in Norfolk and Lincolnshire, where, from their line of flight, they are thought to have crossed the North Sea from the estuaries of the Maas, Scheldt and Rhine, down which rivers they have travelled on their way from central Europe.

From the north coast of Norfolk many birds turn south-west and cross England from the Wash towards the Bristol Channel; others continue to "skirt the coast northwards (which they—the skylarks and grey crows in particular—sometimes do as far as the Tees) proceeding inland at various points as they go. Those forming the left wing, and they are a considerable contingent, pass westward along our Channel shores to reach winter quarters in southern and south-western England and in Ireland, while others doubtless cross towards the shores of France en route for more southern lands"*

The regular autumn migration lasts from September to mid-November, and all the initial foot-and-mouth outbreaks during this time occur in areas which could be affected by the migration. A few of the September outbreaks are rather early for this regular migration, but there is no doubt that some birds arrive in this country from the east as early as August.

The isolated series of outbreaks in Northumberland, Lancashire and North Wales in September, 1912, is interesting, and at the same time puzzling. For one thing they are much further north than any others at that season. Again, there have been three initial outbreaks altogether on the north coast of Wales in 22 years—these constitute the only outbreaks up to date which have arisen on the west coast—and there is a curious coincidence between these and the initial outbreaks in Northumberland, viz.:—

1912.	N. Wales—1st Sept.	Northumberland—9th Sept.	South Lancs.—1st Sept.
1914.	N. Wales—3rd Mar.	Northumberland—16th Feb.	
1920.	N. Wales—22nd Jan.	Northumberland—18th Jan.	North Lancs.—20th Jan.

The Lancashire outbreaks in 1912 and 1920 seem partly to link up the two places. Whether there is really any connection, however, is a matter for speculation; there is certainly migration overland between the north-east and north-west coasts which might account for it, but one would not expect to find birds moving north-east in September or south-west in February-March. There is, however, so long an interval between the latter (16th February—3rd March, 1914) series of outbreaks that they are less likely at least than the others to be connected.

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* W. Eagle Clarke, *Studies in Bird Migration.*

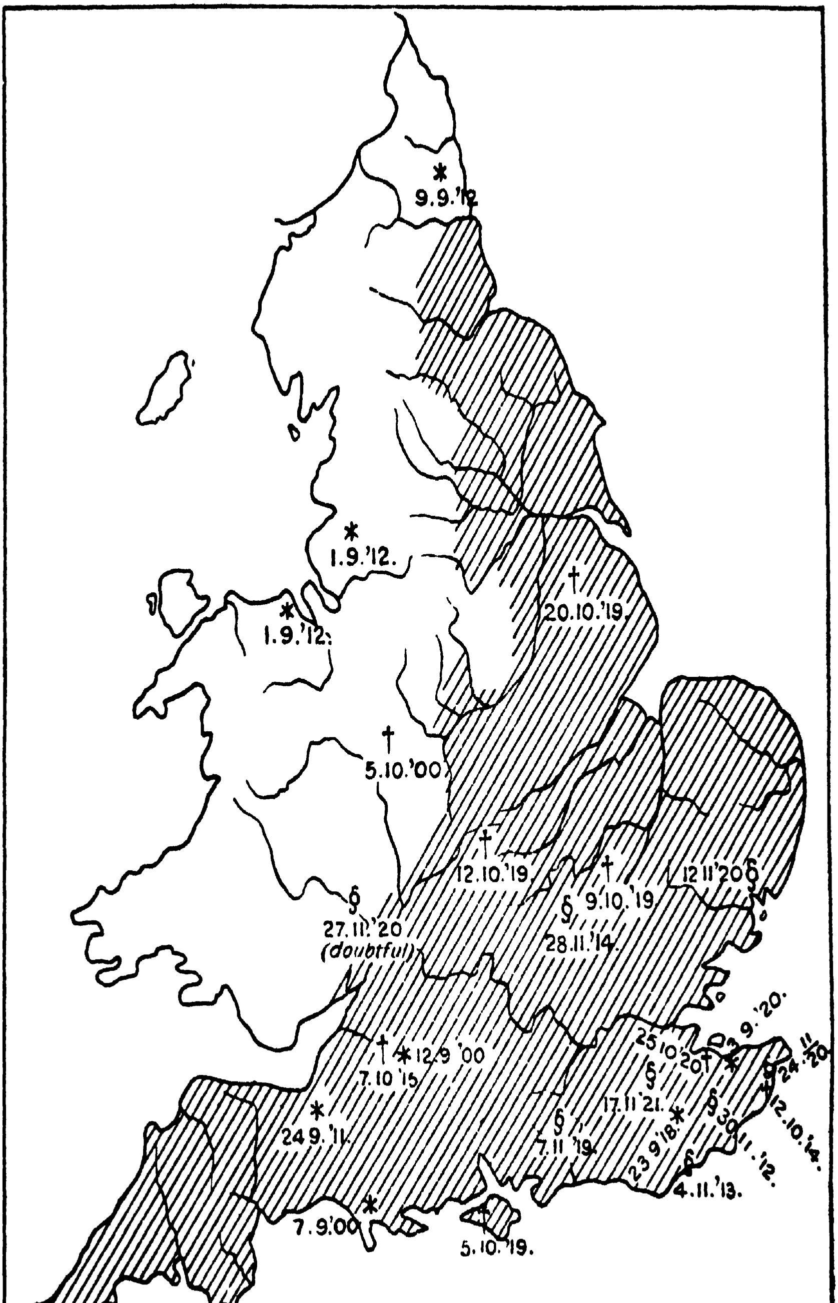
Winter Migrations (Map 6, December, January and February).—After the middle of November the regular autumn migration ceases, but nearly every winter there are spells of hard weather when birds from the Continent are driven to seek refuge in the British Isles, where, especially in the west, the climate is milder.

Many of these birds come by the "east and west" route, their migrations sometimes lasting for days if the weather continues severe, and at such times swarms of birds including rooks, larks, lapwings and great numbers of wildfowl arrive on our east and south-east coasts, most of them travelling westward through southern England, or along the south coast, or crossing to Ireland.

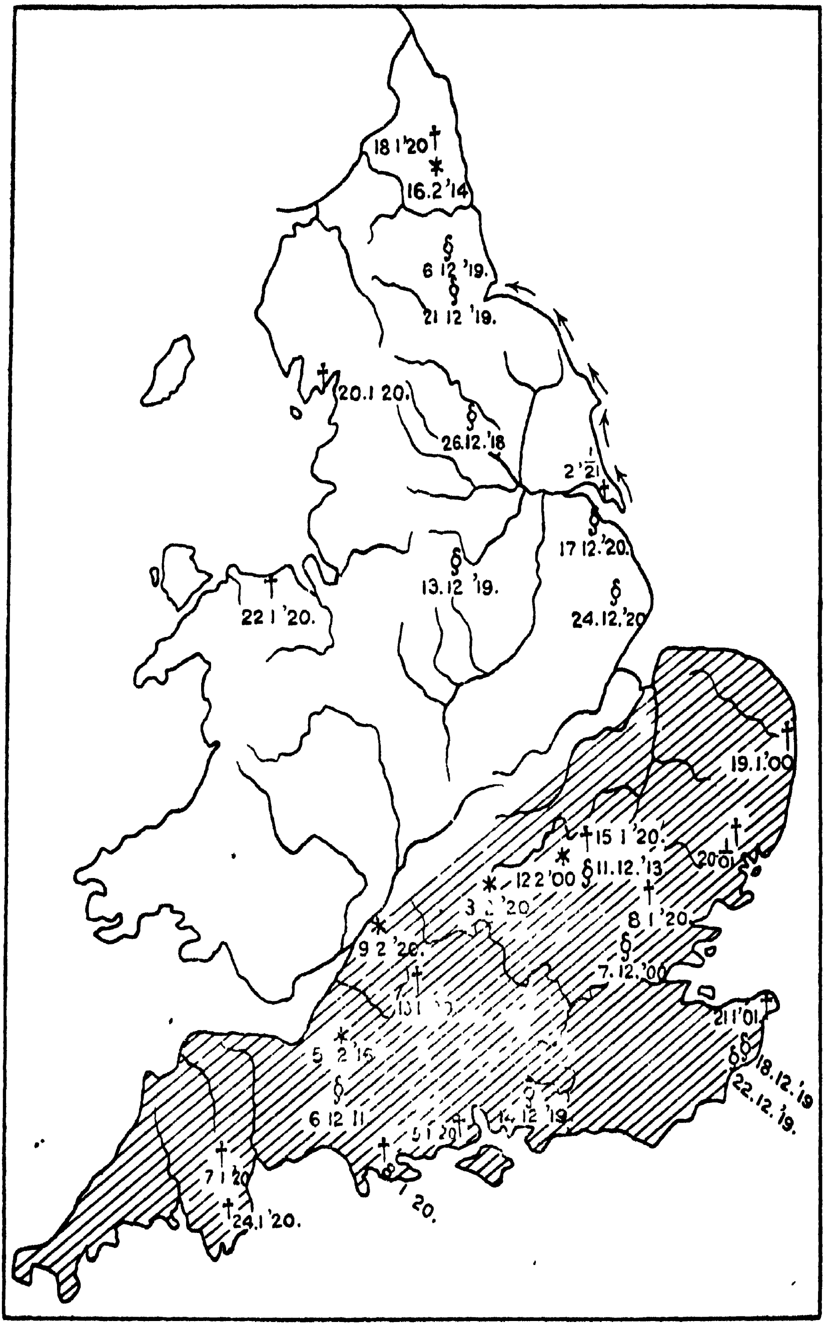
These forced migrations in search of food and shelter may occur at any time between November and March, but the chief months are December and January, which are also months when the number of outbreaks of foot-and-mouth disease is high.

Any of the outbreaks south of the Wash, and after the regular autumn migration season, might have been caused by birds on these weather movements, but there have also been 11 north of the Wash where the "east to west" migrations apparently do not extend at this season.

There is a curious movement of gulls, however, on the north-east in winter, when, during strong north or north-east winds between October and January, great numbers of common gulls, herring gulls and lesser black-headed gulls fly along the shore or over the sea, heading north or north-west against the wind. This movement is observed in Yorkshire from Spurn Point to the Cleveland coast, and opinions differ as to whether it is true migration or only due to the gull habit of flying up wind (not nearly so many gulls return south, however, when the wind changes to south-west). Either way it is possible that birds from the Continent may form some part of the movement, especially as north-east winds in winter often coincide with very cold weather. In Yorkshire during the north-east wind the gulls only fly past over the sea, but there seems to be no mention of them passing up the Northumberland coast, and as the movement depends on wind, it must be of uncertain duration, and it would account for the presence of gulls from the



MAP 5.—Distribution of Outbreaks of Foot-and-Mouth Disease in September, October and November. The shading indicates roughly the area affected by "East and West" migration at this season.



Map 6.—Distribution of Outbreaks of Foot-and-Mouth Disease in December, January and February.

Shading indicates roughly the area chiefly affected by "East and West" migration at this season.

The arrows on the N.E. Coast show the course of Gull movements during N. and N.E. winds.

south on the north-east coast at that season. Once there they might wander anywhere inland in search of food.

These winter movements do not, of course, occur with the regularity of the autumn and spring migrations, and yet there have been more outbreaks of foot-and-mouth disease in December, January and February than in September, October and November. If, therefore, the disease has been brought by birds in these out periods, some further explanation seems necessary. It might depend, however, upon the habits of birds varying with the seasons, as they do. For instance, some which feed in stubble fields in autumn take to the pastures in winter, and so would be more likely in that season, if infective at the time, to infect animals at pasture.

Conclusion.—In conclusion there would appear to be most remarkable relations, both as regards seasons and localities, between the movements of birds and the initial outbreaks of invasion in foot-and-mouth disease in Great Britain. Some of these outbreaks, however, do not correspond with what are believed to be the known facts as regards bird movement. On the other hand, these facts are admittedly incomplete, and the circumstantial evidence as a whole is very far short of being able to establish a negative.

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IMPERIAL ECONOMIC CONFERENCE, 1923: IMPORTATION OF LIVE STOCK.

AT a meeting of the Imperial Economic Conference which was held on 26th October, the question of the Importation of Live Stock was discussed. Those present included:—

The Right Hon. Sir Philip Lloyd Greame, K.B.E., M.C., M.P., President of the Board of Trade. (In the Chair.)
His Grace the Duke of Devonshire, K.G., G.C.M.G., G.C.V.O., Secretary of State for the Colonies.
The Right Hon. L. S. Amery, M.P., First Lord of the Admiralty.
Lieut.-Col. The Hon. Walter Guinness, D.S.O., T.D., M.P., Financial Secretary to the Treasury.
The Right Hon. Sir Robert Sanders, Bart., M.P., Minister of Agriculture and Fisheries.
Lieut.-Col. A. Buckley, D.S.O., M.P., Parliamentary Secretary to the Department of Overseas Trade.
The Right Hon. W. L. Mackenzie King, C.M.G., Prime Minister of Canada.
The Hon. George P. Graham, M.P., LL.D., Minister of Railways and Canals, Canada.
The Right Hon. S. M. Bruce, M.C., Prime Minister of the Commonwealth of Australia.
The Right Hon. W. F. Massey, Prime Minister of New Zealand.
The Hon. Sir James Allen, K.C.B., High Commissioner for New Zealand.
The Hon. H. Burton, K.C., Minister of Finance, Union of South Africa.
Mr. C. A. Innes, C.S.I., C.I.E., Member of the Governor-General's Council for Commerce and Railways, India.
Mr. Dadiba Dalal, C.I.E., High Commissioner for India.
The Hon. W. G. A. Ormsby-Gore, M.P., Parliamentary Under Secretary of State for the Colonies.

The Chairman suggested that the Conference would probably wish the Minister of Agriculture to open the discussion, and Sir Robert Sanders thereupon addressed the Conference.

Sir Robert Sanders: I do not want to go at too great length into the history of what has been a somewhat contentious subject. The position was until a year ago that all live cattle were prevented from coming into these islands and it is under that system that the present generation of agriculturists have carried on their business. That was called the " embargo " and that was imposed by the " Diseases of Animals Act, 1896." I am quite aware that great objection is taken particularly to the name of that Act, an objection which I have heard expressed on several occasions with vehemence, I might almost say with heat. That is really one of the eccentricities of English jurisprudence. We have a large number of Acts of Parliament called by curious names. For instance, we have an Act that says that contracts for the sale of land must be in writing. We call that the Statute of Frauds. There was an Act passed in 1909 under which Local Authorities prohibit Cinema Exhibitions from taking place on Sunday, and censor films that might be calculated to shock the youthful visitor. Well, we call that an Act " to make better provision for securing safety at Cinematograph Exhibitions." Those are the sort of eccentricities that you get in Acts of Parliament. It is rather the rule than the exception that a state of things should arise under an Act of Parliament that has nothing to do with the name of that Act. Now, the next step in this matter is that in consequence of promises made by Lord Ernle in 1917 to Canadian representatives, this subject was brought up in both Houses of Parliament in the summer of 1922, when the following Resolutions were passed :—

In the House of Commons :—

> " That this House is of opinion that the time has arrived when the embargo on the import of Canadian Cattle should be removed "

And in the House of Lords :—

> " That this House accepts the conclusions of the Royal Commission that the Dominion of Canada is free from cattle plague, pleuro-pneumonia and foot-and-mouth disease and is of opinion that steers from the Dominions might be admitted as store cattle to Great Britain, subject to precautions by means of quarantine being taken."

In consequence of these resolutions, an Act was passed last December entitled the " Importation of Animals Act, 1922." That Act authorises the admission of store cattle from Canada. So far as Canada is concerned, we have withdrawn unreservedly any suggestion that her cattle should be excluded on grounds of disease. The stigma to which she objected, which was imposed by the Diseases of Animals Act, has been removed by the

Importation of Animals Act of last year. I understand, however, that Canada is not completely satisfied and that she desires not only free import for her store cattle as defined in the Act, but also free access to our inland markets for her fat cattle. With regard to this request, I must point out that the British Government must have regard primarily to the interests of its own producers. I think that principle has been admitted more than once during this Economic Conference. Canada has been accustomed for the last generation to send us her fat cattle for slaughter at the ports. It is still open to her to do so. The removal of the embargo on store cattle does not justify a claim that additional privileges should be given to fat cattle, if, as most certainly is the case, the representatives of British agriculture are convinced that it would be detrimental to their interests. This definition of store cattle was inserted in the Act by the House of Commons without any pressure from the Government. It is not embodied in a Diseases of Animals Act, so that it casts no stigma on the health of Canadian cattle, whether store or fat, and it must be regarded as a matter of domestic policy adopted in the interests of our own producers. I cannot hold out any hope, therefore, that the Government will propose or that Parliament would accept any alteration of a decision that was deliberately arrived at less than a year ago.

The second clause of the Act authorises the Minister to admit by Order Canadian animals other than stores. Such Order, however, has to be approved by both Houses of Parliament. My predecessor, Sir Arthur Boscawen, had informed the Canadians of his intention to introduce such an Order at an early date and was under the impression that he would be supported by the agricultural interests of the country in doing so. When, however, I came to look into the question I found that that impression was based upon a misapprehension and that all classes of our agricultural community were strongly opposed to admitting breeding cattle into the country. So strong was that opposition that I thought it very unlikely that such an Order would be confirmed by Parliament. Probably it is not generally recognised what an important matter our pedigree herds are to English agriculture. They have been built up mainly by private effort, though latterly the Government has given some assistance, and although they comprise only a small proportion of the total stock of cattle in the country they influence the quality of a vast number of animals that are not pedigree. Our agriculturists are exceedingly nervous about anything that would in any way reduce the class of our stock which we have done so much of late years to improve and they are firmly opposed to the admission of breeding cattle to this country.

Mr. Massey: You mean stud cattle?

Sir R. Sanders: Yes. It is only right for me to say that this applies to all breeding cattle and that the strong feeling of the great majority of agriculturists is against making any further relaxation of the present system.

So far as the majority of the Dominions are concerned, geographical considerations must limit the importation of cattle from the Empire to Great Britain to valuable animals which will realise a high price. Having regard to the paramount importance of safeguarding the interests of our own breeders and our valuable trade in the export of pedigree stock not only to the Dominions but also to foreign countries, the British Government, while anxious to promote inter-Imperial trade and to give the best possible terms to the Dominions, would not feel justified in doing more than to undertake to introduce legislation to facilitate the exchange of pedigree stock throughout the Empire as a whole on reciprocal terms. subject always to satisfactory precautions being taken against the introduction of disease.

Mr. Graham: Mr. President, I am not sure just why a question of this kind should be brought before the Economic Conference unless it be to provide a jury at the trial of this question. This matter was thrashed out for a great many years, Canada strongly objecting that the reason given for shutting out her cattle that they were diseased was not founded on fact, and full investigation has proved the truth of the contention. There was no reason in our mind to exclude Canadian cattle for very many years under the Animals Diseases Act. Now, it has been stated that it is an eccentricity, I might call it, of British jurisprudence. that you often call things by their improper names in the title of Statutes, as the question of protecting children in the cinemas, etc. Well, in that case, there was no stigma placed on cinema men, the Act was careful in its title—true to make it mean something it did not mean—but it was careful not to place any stigma on the business of the cinema men. But in this case for many years we have suffered under the allegation that cattle disease was rampant in Canada, which was not the case. I might add just here that, although in a measure the embargo has been lifted, portions of our cattle under the enforcement of regulations are still suffering from the stigma, because when an inspector, in classifying the cattle landed declares that any cattle come under what might be called the "fat class," they are slaughtered on the dock as if they were diseased cattle under the Animals Diseases Act. There is no pretension by anybody that there is any disease in the cattle, they are not slaughtered because they are diseased, but are slaughtered because they are considered not to come under the technical stocker class. We think that is an incongruity and an injustice.

To come down to 1922, I must say with brutal frankness that the Canadian people are very much disappointed. After arriving at an agreement with the British Government along certain lines, we are disappointed to find out that the Statute passed did not comply with the terms of the understanding. There was a restriction defining "store" or "stocker" cattle placed in the Act which was not considered, I believe, at the Conference between the Finance Minister of Canada, the Minister of Marine and Fisheries, and the British Government. It has been stated that that was introduced by a private Member, and while I do not wish to criticise it, as that is the business of the British Government, I am inclined to think that, if the Government had resisted the amendment, it would not have been pressed, much less passed; but that is the business of the British Government.

Now I pass on to the present difficulty, because, if the Act had been passed as was discussed at the Conference, it would have left the door much wider open. I admit that there are difficulties in passing Statutes, in enacting Statutes in Parliament, perhaps on the inside that may not be discernible on the outside. I have had experience along that line myself. We have arrived at this stage. We do think that the Act, or that portion of the Act providing for the admission of breeding cattle or cattle capable of breeding should be made operative. It must have been so intended, else it would not have been placed in the Statute, and we feel that, while we cannot press it further, it is a fact that the British Government is not complying entirely with the understanding arrived at between the two Governments.

A matter that has not been mentioned is this. Provision has been made now for classification as between stockers and fat cattle and we contend that that was not anticipated in the Conference. But even under the Statute as passed which contained the new restrictive clauses this inspection has been carried on not only with a detrimental effect to the Canadian cattle trade but with an injustice to the Canadian cattle trade. Stockers have to comply with certain restrictions—branding, detention and that kind of thing—to which fat cattle are not subjected. Then stockers have to be kept separate from fat cattle, and there are various restrictions to which what we call fat cattle are not subject. These cattle that are shipped as stockers from Canada arrive at the port in Great Britain, and it is our contention, we think based upon fact, that the spirit of the Act, the spirit of the arrangement is not being carried out but is being nullified by the details of the inspection. In other words, that cattle that are really stockers or store cattle and capable of being fed for weeks and months with great improvement are placed in the category of fat cattle when they arrive here. and are not even allowed to be taken a few hundred yards to another abattoir, but are slaughtered on the docks. They are slaughtered under the Animals Diseases Act though they are not diseased, with great detriment to the reputation of Canadian cattle. Further, these animals which we contend are not fat, are slaughtered and their carcasses must be sold. Canadian meat of an inferior quality is thus placed on the market. It is not fed up to the point of superiority of which it is capable, and Canadian beef is put down as an inferior article because the cattle are called fat by an inspector and slaughtered that neither we in Canada nor you in Great Britain would under any other circumstances think of slaughtering for the market. It is not out of place for me to give a detail or two. Several head of cattle were sent over here a few days ago by the Canadian Government as store cattle, cattle that in our country would be considered stockers, cattle that I have no hesitation in saying your farmers would call stockers if they owned them, and would feed them at least until the Christmas trade arrived. There were some 60 of these. They were all eventually put down as fat cattle and slaughtered; showing a distinct conflict of opinion between our experts in Canada and the inspectors here. I could give other details.

Another question has been raised which I do not think was ever in the mind of the British Government, and that is, inspectors have undertaken to say not only that cattle are too fat but that others are too poor. Surely that was not the intention that the inspector was to classify an animal as one that should not be sold to a farmer to fatten if he wanted to buy it. There was in one shipment of cattle carried recently quite a number of exceptionally poor cattle. I had hoped to have had the photographs of them here to-day, but they have not arrived. These cattle were not considered too fat. They were considered too poor and not of the proper class of cattle for the British farmer to fatten. That surely is an intervention with trade not contemplated in the Act. To my mind under that Statute the inspector would have just as much right to inspect a horse of mine that I was selling over here and to say it was not fit for the market. The idea and the whole intention of the Act was that cattle should come over here to be fatted, and the class of animal would be a thing between the farmer here and the seller in Canada. I only mention that to show to what extent the inspection goes.

I do not know that I need go into any more details. We are thoroughly disappointed. I could read much stronger language than I would think proper to use, but we feel that not only are our farmers disappointed after being shut out of the market for 30 years on account of diseases which did not exist but that the agreement made is being disregarded. The door opened, cattle were coming in freely, and were being sold and purchased rapidly by the farmers here for fattening, but all at once, the door is in a measure closed. Now the shutting out of these fat cattle or of cattle that are called fat by inspectors, is of far greater moment than it may appear. It has this result, that the raisers and stock breeders in Canada are beginning to think that there is no use in endeavouring to take advantage any more of this market because they do not know whether an animal will be declared fat when it gets over here or not, and the slaughter of all these animals so declared to be fat animals, but which we contend are not, has always been done not only with loss to the immediate interest but to the detriment of the good name of Canada and the beef which our best cattle produce.

A suggestion was made by the Minister of Agriculture as to an arrangement for the interchange of pedigree stock. Possibly it would be of some benefit, but it will not cure the situation as to the exclusion of our good grade stock which might be capable of breeding. But the immediate trouble, and the greatest disappointment we in Canada have, is the fact that cattle we send over as we believe under the Statute are classified so as to nullify much of the good that should come to our trade under the Statute.

Then we cannot see why we should be used differently from any other Dominion. We would not at all say that any other Dominion should be deprived of anything it has on our account. Not at all. But we believe if trade is to be Imperial the benefits must be reciprocal. It is a fact, so I am informed, and is publicly stated in our Press, in an interview with the *Montreal Gazette* (perhaps one of the sanest newspapers in the British Empire) that Canada's cattle do not receive the same treatment as at least one other Dominion, in that their cattle after certain days of quarantine in England are allowed to be sold anywhere either as stocker or fat cattle. All those restrictions are put against our trade. As I said in the first place I am not sure this should be dealt with at the Conference as it is a matter between the Canadian Government and the British Government. I have endeavoured to place our side of the case as impassionately as possible before the Conference. We think the spirit of the Act is being nullified by the system of inspection, and that the advantages which were intended to be had for Imperial trade are not being experienced; and as a result of it all, the Canadian farmer feels greatly aggrieved and greatly disappointed in that he is not getting what he was assured he was to get in the way of freedom of entry for his cattle into the British market.

Mr. Bruce: Sir Philip, I have got very little to say with regard to this matter. It is one, of course, which primarily concerns Canada. There is one point, however, I want to draw attention to, and, particularly, in view of the last few words that Mr. Graham uttered. He said he did not see why Canada should be treated differently from other Dominions. It is suggested that, while there may be some questions upon which there is a difference of opinion, Canada is being treated very advantageously as against any other Dominion at the present moment. Really that is the only point that I want to raise, and I do want to utter a protest with regard to it. It is that under the Diseases of Animals Act, 1894, we are excluded from this country, and there is an implied suggestion that there is some disease in Australian cattle. That I absolutely repudiate, and say that there are no possible grounds for any such suggestion. I appreciate all that Sir Robert said at the beginning as to the naming of Acts and so on, but none the less that is a position which I want to utter a protest against. As to the actual question under discussion, we have nothing to say about it, but it is true that it is not a trade with which we are actually concerned, but we certainly do want to maintain the position which we have taken up very definitely indeed with regard to our own country. It is that we have a perfect right to take whatever action we consider necessary in the interests of our own particular producers. We take a very definite stand on that, and we say that nobody is entitled to try to dictate to us as to what we shall do for the protection of the people who are our own particular producers, and having taken that view, we certainly would not think for one second of attempting to force any other Government to take any action which was against the interests of their own particular producers, and I do not think it is dictated by a feeling of apprehension that we might be weakening our own position. I think we do accept that as a fundamental principle that we are prepared to adhere to, and naturally we could not express any views which could be interpreted as trying to force somebody else to do what we are certainly not prepared to do ourselves.

Mr. Massey: I hardly think that New Zealand is very seriously concerned in the shipment of live stock from that country to Great Britain. I do not think anything of the sort is possible; the voyage is too long. Of course, in saying that it is well to admit that stud stock are occasionally carried from England to New Zealand and a few the other way. Every year a certain number of horses and cattle are shipped and I suppose that will continue.

Sir Robert Sanders: The trade in horses is perfectly free.

Mr. Massey: I am glad to hear that. I just want to emphasize the point which has been referred to by the Prime Minister of Australia. So far as disease is concerned we have practically none. I want to qualify that by saying that I believe we have probably the same proportion of tuberculosis in our cattle as will be found in every other country in the world. There is no country that I know of free from tuberculosis, but in stock we have no such thing as foot-and-mouth disease, and I know you have had it here pretty often. We have no anthrax; I have heard of that in the United Kingdom. I am glad to think that measures have been taken to stamp them both out. So far as I know, neither of those diseases is prevalent in England at present. Horses are not affected by what is proposed, but I want to raise this point. You have a big exhibition coming on here next year which I hope will be a tremendous success, and, if so, I believe it will do every country in the Empire a great deal of good. What are you going to do with regard to stock coming over for that exhibition?

Sir Robert Sanders: There is a clause in the Act of 1896 by which the Board may make such Orders as they think fit for allowing the importation of foreign animals for exhibition purposes.

Mr. Massey: Will there be permission to dispose of them in this country? I may say I was consulted about this before I left New Zealand, and the opinion I expressed was simply that I hardly thought either cattle or horses would be sent to England for exhibition purposes. New Zealand is one of the countries where stud stock does not deteriorate. I believe we could with advantage send over some sheep that would be an object lesson to Britain I am speaking of the breed peculiar to New Zealand—Corridales. They have spread very rapidly all over the Dominion and they are useful both for mutton and for wool I should like to know something definite about it. I do not say our people do not want to send horses. I only say that, in my opinion, it would not be worth while. You have had very good horses imported from New Zealand before to-day. I would like to know what is going to be done definitely with regard to the animals coming from overseas for the exhibition, whether they would be allowed to be disposed of here, because it would be of no use bringing stock here and intending to take them back. Very few people could stand the expense and I would not be inclined to encourage it.

Sir Robert Sanders: They would be in very small numbers.

The Chairman: The exhibition would not hold a great lot of them.

Mr. Massey: I presume each country finds room for its own exhibits.

The Duke of Devonshire: I am not speaking as Colonial Secretary now, but as connected with the British Empire Exhibition. If you send the stock and it is allowed to come by the Sanitary and Local Authorities of Wembley, who may have to be consulted in the matter, I will undertake to say that you will be able to get rid of it to the best advantage you can.

Mr. Massey: That is something definite and I am very glad to get that. It would not be satisfactory if I could not tell my people something definite when I go back. There is another point. I am raising this in the interests of British agriculturists as well as my fellow citizens. If they want to benefit themselves let them look at the fact that South America is gradually taking possession of the whole beef market in Britain. That is the position to-day. I can only speak from memory, but I believe that last year 5,000,000 quarters of beef came into this country from South America, and I know perfectly well that the British farmer cannot produce fat stock—I am speaking of cattle—anything like so cheaply as the man in the Argentine can, or one of the other States there, and send it to England.

I am interested, of course, as representing a great producing country, but I think the interests of the British agriculturists come even before those of the New Zealand farmer and are very much more seriously affected. I am not worrying about lamb and mutton. We can beat them in lamb and mutton every time, but we simply cannot stand up to them with beef. I have advised New Zealand to drop the shipment of beef and go in for something else. I do not know that I have anything more to say. I am very glad to have this statement from the Duke of Devonshire with regard to the exhibition of stock which New Zealand is inclined to send.

Mr. Burton: This seems to me to be really a matter for settlement between the Dominion concerned and the British Government more than for this Conference. I have nothing to say about that, but I should just like to say that I welcome the statement made by Sir Robert Sanders with regard to the promise to facilitate this exchange of pedigree stock. As far as I am aware that would be of considerable value to South Africa and I look at it from that point of view.

Mr. Riordan: As the statement made by Sir Robert Sanders in no way affects the interests of the Irish cattle trade, I shall not delay the Conference with any further remarks.

Mr. Mackenzie King: In the first place, I would like to mention again what I said at the opening meeting, that we appreciated in Canada the difficulties with which the British Government were confronted in this matter and appreciated sincerely the action of the Government in seeing that the embargo was removed, giving admission to our cattle. We wished to do something more than give verbal appreciation of that action, and we increased the British preference, amongst other things, in the hope that the British public would realise that having met us in a matter in which we were vitally concerned we, in like measure, would like to meet them in a matter which was of concern to British interests. We increased our preference by giving an additional 10 per cent. discount on the existing preferential duties on all goods coming through Canadian Ports. I want to make it clear that this was done largely as the result of the action of the British Government in respect to the admission of our cattle. We intend to hold to what we have done.

Our attitude in the matter of preference is one of trying to further as much as we can inter-Imperial trade. The point which I think we would stress most strongly—and it is a point, I think, which is felt equally on this side—is the importance of carrying out whatever agreements may be reached in the spirit as well as in the letter. We have no desire to do other than live up to an agreement that we have made, and we expect the British Government to adopt the same attitude, not only by itself and its Ministers, but through its officials. We think the officials should be definitely instructed as to what is the agreement and understanding in this matter. As Mr. Graham has pointed out there was a definite agreement made between the Ministers of the Crown of Canada and the Ministers of the Crown here, as to what was to constitute the provisions of an Act of Parliament. That agreement was altered somewhat by an amendment of the Act. That was a disappointment, but we realised that the Government had its difficulties in a measure of this kind when it came into the House of Commons and the House of Lords.

However, the Act itself stands for the voice of the British Parliament, and at the moment we find a further disappointment in that the Minister of Agriculture tells us distinctly that, though the Act has a clause referring to the admission of breeding cattle, which has been framed with a view to giving practical expression to another phase of the agreement, he will find it impossible to introduce the Order which would give force to that clause of the Act and make it of service to us. That must necessarily occasion another considerable disappointment. It distinctly cuts down the value of the legislation and distinctly limits what we hoped and expected would be the outcome of the agreement.

Now, as to the difficulties, there again let me say that our Government are prepared to be as considerate in every particular of the difficulties with which the British Government is confronted as can reasonably be expected, but there is a limit to which consideration can go. If the Act in its provisions is to be whittled away clause by clause and what is left to be completely whittled away by the method of administration, of what avail is it? That brings me to the last point, namely, the administration and regulations in regard to the admission of store cattle. As Mr. Graham has pointed out, that is really very serious, because it affects our cattle in two ways. In the first place, it brings back a certain stigma which the Minister has rightly stated was never justified, and which the British Government is anxious to have removed completely, but in the second place it gives to our beef in the British market a reputation which it does not deserve. Indeed, it may conceivably help to destroy the very trade it was intended to further. If we send our cattle in as store cattle, lean and thin, and with the intention of having them fattened here, and they are slaughtered immediately and put on the British market as Canadian beef, it will not take very much in the way of marketing that kind of beef to destroy any reputation our cattle may have. One can see how the farmers of Canada would naturally be very sensitive on a point of that kind. I believe if the Minister of Agriculture will say that in the carrying out of the legislation he will see that instructions are given to his officials to the effect that the spirit of the law must be lived up to, and that Canadian cattle coming in as store cattle must not be put into a classification into which they should not properly be placed, he will go a long way to remove what Mr. Graham rightly referred to as a feeling of great disappointment and some indignation at the moment. I think it is entirely to the interests of British trade with Canada and our trade with Britain that irritations of that kind should not be permitted to develop. If they start on one side there is apt to be retaliation on the other, whereas all that we want is to carry out whatever agreement we have in a spirit of goodwill and liberal interpretation.

I might mention a concrete case that was brought to my attention this morning, of a shipment of cattle that was sent over from Canada to two different ports. The single shipment was divided into two lots, one lot of 50 being sent to one port and the other lot to another port. At the one port those stockers were classified as fat cattle and slaughtered immediately. At the other port they were admitted as stockers and so regarded.

The Chairman: All out of the same lot?

Mr. Mackenzie King: Yes, all out of the same lot. I do not mind saying that our shippers are anxious to find out how the law is being administered. This I believe was done designedly by one shipper who divided his shipment into half and sent half to each of the two ports, at the one port they were slaughtered immediately, at the other port they were admitted and regarded as store cattle. That is an actual fact within the past week. It bears out what I say, that some of the officials of the Departments are evidently over-zealous in taking a certain course, at some ports at least, and I think that what is most needed is that the Government itself should make known to its officials the view that was expressed by the Government to our own Ministers.

Sir Robert Sanders: With regard to this question about the store and fat cattle, what the officials of my Department have to do is to carry out the words of an Act of Parliament. The words of the Act of Parliament are that the cattle "must be intended for feeding purposes and not for immediate slaughter." Of course, as I said in the House of Commons once, it is a very difficult thing to calculate the exact amount of obesity that would justify immediate slaughter. I will have it looked into, certainly, but the officials of the Department are as competent men as you can find for judging what, after all, is a somewhat difficult question.

As to the question of the cattle that are too poor, I should like to have further particulars, if Mr. Graham would let me have them. I should be very happy to have the case looked into.

In the course of further discussion the Dominion representatives welcomed the suggestion that arrangements might be made for the reciprocal exchange of pedigree stock, and the Minister of Agriculture agreed to discuss with the Canadian representatives the points they had raised as to the administration of the Act regulating the importation of Canadian Store Cattle.

* * * * * *

THE PREVENTION OF BUNT IN WHEAT.

THOUSANDS of bushels of wheat are lost annually in England through neglect of a proper pickling of seed wheat against bunt. When a diseased crop is threshed most of the bunted grains burst, the fine black spores are liberated in clouds and the healthy grains become coated with them. Winnowing may be sufficient to remove unburst bunted grains and broken fragments, but it obviously cannot free the grain from the spores. Grain may also become contaminated from the thresher if the latter has been used previously to thresh the produce of an infected crop, and previously used sacks have been known to contaminate seed corn placed in them in the same way.

The manner of infection is through the young seedling wheat. The spores are carried on the grain and germinate on the softening coat. Once in the plant, the fungus spawn grows with it, maintaining itself near the apex of the plant, and when the ear is formed it makes its way into the young grain. As the plant food passes into the ear for the growth of the grain, the parasite seizes upon it, destroys the tissues, and eventually produces a solid mass of black spores in the grain.

The pickling of seed wheat by a solution of formalin has been tried on a large scale and found reliable. (Formalin is a liquid containing approximately 40 per cent. of formaldehyde gas in solution.) The Ministry recommends the use of this, the solution being at the rate of one part formalin to 320 parts of water (*i.e* , 1 pint formalin to 40 gallons of water). Mr. E. S. Salmon found that complete control of bunt was secured by using formalin at the rate of 1 pint to 60 gallons of water. From one to two gallons of the solution should be sufficient for four bushels of wheat. It should be slowly sprinkled or sprayed over the grain, which should be stirred, so that all the grains become thoroughly moistened. The solution should not be allowed to form pools under the heap of grain. The seed should then be placed in a heap and covered with sacks soaked in the solution, but not too wet. The seed may then be left for four hours, after which it should be spread out to dry on a clean floor which has been disinfected by formalin solution and allowed to dry before the seed is spread upon it. The sacks in which the seed is to be placed should be treated with formalin solution in the same way, or boiled in water and subsequently dried. Seed wheat treated as advised suffers slightly in germination, and should therefore be sown a little thicker than is usual.

PIG-KEEPING.

III.

W. A. STEWART, M.A., B.Sc. (Agr.),
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Systematic Rationing.—The quantity of food required by a growing or fattening pig will depend largely upon its size, and this can be gauged approximately by its weight. Generally speaking, a growing or fattening pig will need about 1 lb. of mixed meal for every 20 lb. of live weight. This is, roughly, equivalent to 1 lb. for every 4 weeks of age. On this basis we can construct the following table which may be taken as a guide :—

TABLE I.

Age.	*Approximate Live Weight.*	*Total Meal per head per day.*
3-6 weeks.	20-30 lb.	1-1½ lb.
6-12 „	30-50 „	1½-2½ „
12-16 „	50-80 „	2½-4 „
16-20 „	80-120 „	4-5½ „
20-24 „	120-170 „	5½-7½ „
24-30 „	170-220 „	7½-9 „
Sows in pig	- - - - -	4-6 „
Sows in milk	- - - - -	8-10 „
Stock boars	- - - - -	4-6 „

It should be recognised that these figures are simple representative of a large number of average cases. It is quite possible that breeders and feeders can quote higher weights secured with less liberal diets at earlier ages, but we are not dealing with exceptional cases.

It is doubtful whether it is ever economical to exceed 9 lb. of meal per day to a fattening pig. Even when as much as 9 lb. is given some considerable proportion may pass through undigested in the dung. It is generally advisable to replace some part of the meal ration by using roots or greenstuff. The following figures show the weights of roots and forage crops which are roughly equivalent to 1 lb. of barley meal.

Potatoes	4 lb.
Rape, vetches, lucerne, grass	8-10 lb.
Mangolds, swedes	9-11 lb.

Rations for Different Classes of Pigs.—Working on the figures for albuminoid ratios and total quantities which have been suggested as guides, and taking such well-known feeding stuffs as fish meal, linseed cake, pollards, barley meal and bran, rations could be compounded as follows:—

TABLE II.

Age of Pig.	*Fish Meal.*	*Linseed Cake.*	*Pollards.*	*Barley Meal.*	*Bran.*	*Quantity of mixture per head per day.*
	%	%	%	%	%	lb.
3-6 weeks ...	10	10	70	10	—	1-1½
6-12 „ ...	10	10	50	30	—	1½-2½
12-16 „ ...	10	10	30	50	—	2½-4
16-20 „ ...						
* Bacon pigs .	10	10	20	60	—	4-5½
* Pork pigs ...	—	10	20	70	—	4-5½
20-24 weeks						
Bacon pigs ...	10	10	20	60	—	5½-7½
24-30 weeks						
Bacon pigs ...	—	10	20	70	—	7½-9
Sows in milk ...	10	10	50	20	10	8-10
Sows in pig Stock boars ...	10	10	40	40	—	4-6

* Different rations are given for bacon and for pork pigs of these ages because the pork pigs will be slaughtered at say 20 weeks old and should have a ration with a wider albuminoid ratio than pigs being fed and kept on to 28-30 weeks old for bacon.

The feeding stuffs used in Table II are particularly safe and have been found to give excellent results, but they are sometimes expensive, and at times it may be economical—more especially in the case of pigs over the age of 12 weeks—to introduce other and cheaper feeding stuffs. Palm kernel cake and rice meal are frequently the cheapest feeding stuffs on the market, and if green food is used with them they can be employed with satisfactory results. In the special cases, however, of young pigs under the age of 12 weeks and sows in the early stages of suckling their litters, unless linseed cake, pollards, barley meal and bran are very much more expensive than other feeding stuffs it is doubtful whether it is really economical to substitute other feeding stuffs in their place.

TABLE III.

Rations including Cheap Feeding Stuffs such as Palm Kernel Cake and Rice Meal.

Age of Pig.	*Fish Meal.*	*Palm Kernel Cake.*	*Pollards.*	*Barley Meal.*	*Rice Meal.*
	%	%	%	%	%
12-16 weeks ...	10	20	20	25	25
16-20 „					
* Bacon pigs ...	10	20	10	30	30
* Pork pigs ...	—	20	20	30	30
20-24 weeks					
Bacon pigs ...	10	20	10	30	30
24-30 weeks					
Bacon pigs ...	—	20	20	30	30
In-pig sows and	10	20	30	20	20
gilts and boars	or 10	20	30	40	—

* See footnote to Table II.

Table IV.

Rations composed of Home-Grown Feeding Stuffs and Fish Meal.

Age of Pig.	*Fish Meal.*	*Beans.*	*Wheat.*	*Barley.*
	%	%	%	%
12-16 weeks	10	25	25	40
16-20 „				
* Bacon pigs ...	10	20	20	50
* Pork pigs ...	—	20	20	60
20-24 weeks Bacon pigs	10	20	20	50
24-30 „ „ „	—	20	20	60
In-pig sows and gilts and boars ...	10	25	25	40

* See footnote to Table II.

Other feeding stuffs such as maize gluten feed, palm kernel cake and coconut cake could be used in place of beans. Maize germ meal might be used to replace wheat, and maize might be employed as a substitute for barley. Any number of different rations can be made up in this way, and the feeder should consider carefully current market values with a view to effecting economies in the making up of rations.

Feeding.—All changes both in quantity and composition of the ration should be brought about gradually. The pig should never be given more wet food than it will readily clear up. If it receives too much it may overeat and upset the digestion. This will cause a check in the rate of growth and development. Such checks do not appear to occur with dry feeding, even though an unlimited supply of food is given, provided that a slow-acting automatic feeder is employed. One of the commonest errors in wet feeding practice is the use of too much water. The food when soaked should be fed normally as a thick porridge, but the quantity of water requires to be varied according to the weather. Meals should be given regularly. Theoretically the oftener the pig can be fed the better. Three meals per day give better results than two, but it is doubtful whether it is economical to feed oftener than three times daily. Two meals daily is the common commercial practice, which is quite satisfactory. When a pig suffers from constipation or goes stiff through overeating the quantity of food should be temporarily reduced and the diet changed for a time to pollards with a small proportion of linseed cake and bran. Frequently too much starchy food, such as barley or maize, is given to young breeding stock. This produces a soft " flabby " appearance, and if continued to excess may interfere with the breeding capacity.

Young pigs will usually begin to eat at 3 to 5 weeks old, this variation in age depending upon the size of the litter and whether or not the sow is a good milker. At this age new or separated milk is particularly valuable, but the mixture of pollards, fish meal, linseed cake and barley has given excellent results. This mixture can be used either wet after being soaked or simply dry. When given dry it is most important to see that the little pigs get all the water they need. They should have free access to a water supply. On dry food little pigs are less liable to scour and less likely to develop "paunchiness" than when fed on sloppy food.

It should not be overlooked that no matter how correct the ration may be as regards composition and quantity, good results will not be obtained unless a careful watch is kept upon the pigs and the closest attention paid to the other details of management. If the housing conditions are wet, dark, damp and insanitary, pigs will not thrive. Exercise, fresh air, sunshine, a dry bed, and green food are all as essential as a well balanced ration. It should not be supposed that the pig can live under any sort of conditions without care and consideration. Neglect very soon leads to disaster. It should be remembered that the pig is the most prolific animal and the most rapid grower on the farm. This being so, it all the more needs and deserves reasonable care and attention.

So much has been written on the subject of vitamins that certain pig keepers are very apt to conclude that all their troubles are due to vitamin deficiency. Our experience suggests that the cases of actual vitamin deficiency are probably comparatively few. Much commoner causes of troubles are badly bred pigs, unhealthy and insanitary housing and surroundings, dirty troughs, badly balanced rations, too much water in the food, insufficient attention, and failure to recognise incipient illness or, disorders. No one should take up pig-keeping hoping to make it profitable unless he or she is thoroughly interested in it and, being endowed with an open yet critical mind, is prepared to learn both from the accumulated fund of practical experience and the lessons of experimental science.

NOTE :—With reference to the inclusion of fish meal in Tables II, III and IV, it should be pointed out that the Ministry's Leaflet No. 333, which deals with this feeding stuff, is not at present being issued. Its temporary withdrawal was due to representations made to the Ministry by the Pork Section of the National Federation of Meat Traders Associations, which left no doubt that owing to carelessness, both with regard to the quality and the quantity of fish meal fed to pigs, tainted pork and bacon are of somewhat too frequent occurrence.

It should be possible, however, to use suitable brands of fish meal up to within four weeks of killing, with perfect safety as regards tainting, if sufficient care is taken not to exceed the proportion recommended. The rations in the tables are designed with the idea that fish meal is omitted during the last four weeks of feeding.

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FOWLS ON THE FARM.

J. W. HURST.

DURING 1922 the poultry produce imported into the United Kingdom (mainly Great Britain) from countries abroad, exclusive of Ireland, exceeded £15,000.000 in value; and the Irish exports, nearly all of which entered Britain, approximated to a value of £11.000,000 in 1921. These are big figures, yet it is to be noted that the quantities of eggs and poultry imported fall considerably short of pre-war dimensions. The warning given by the Departmental Committee on Distribution and Prices of Agricultural Produce is to the effect that "producers in those Continental countries which, owing to internal conditions, have temporarily ceased to export poultry produce to these shores will sooner or later seek to re-enter the British market."

On the other hand, the estimated value of the production of eggs and poultry on the agricultural holdings of Great Britain in 1922 is given as £16,000.000 (Part III. *Agricultural Statistics*, 1922). This estimate does not include the production of fowls kept by cottagers and private residents, and these have been assumed to be about one-third as many as the birds kept on agricultural holdings. However that may be, it does not affect very materially the obvious conclusion that farmers, as such, have an immense opportunity for the development of poultry keeping as a specific branch of their work.

It is, perhaps, necessary at the present time to reaffirm and emphasise the fact that the great bulk of the eggs and table poultry produced and marketed in this country are the output of general farms and that it is mainly in connection with other uses of agricultural land that there exists such scope for that expansion and development that alone will resist foreign competition. It is true that there has been a remarkable increase in the number of commercial egg farms during the past few years, but the combined output of such establishments is very small by comparison with the farmers' bulk of poultry produce.

Nevertheless, this production in the past has been almost fortuitous, and farmers as a class have not yet begun to realise the extent of the influence they are capable of exercising upon the egg and table poultry trade of this country. Until quite recent years the fowl on the farm was regarded rather as an unconsidered trifle than a business proposition. It has remained for specialist breeders to provide proof--through the medium of the egg-laying tests—of the possibilities of prolificacy and profit that exist in the poultry industry. Yet the mere multiplication of specialist breeders, and the efforts of commercial egg farmers, will probably not be commensurate to the needs of the future, or sufficient to enable the home industry to take full advantage of the more immediate opportunity.

The chief hope in this direction lies in the largely unrealised and at present latent power of general farmers to develop egg and poultry production as a serious branch of agriculture. The general farmers throughout the country are the only people who are in a position to increase the aggregate output sufficiently without avoidable loss of time. They also are, as a class, able to do so under the most favourable economic conditions.

Advantages of Position.—Farmers are already in occupation of the required areas of land. They have no need for any great capital expenditure upon plant, their fowls find the most suitable accommodation imaginable, and their produce need carry no undue proportion of establishment charges. Moreover, his knowledge and experience of live-stock keeping generally should enable the average farmer to appreciate broadly the requirements in this branch of production, and to realise the benefits that result from good management. The agriculturist, therefore, possesses special advantages that qualify and equip him more particularly than others to make the most of the opportunity that exists in this direction. Circumstances have recently combined to turn his attention more seriously and definitely than hitherto to remunerative side lines. These must bulk more largely now than formerly in his plans.

There are considerable and essential differences between what is termed commercial poultry farming and farm poultry keeping. The former necessitates a relatively big initial outlay, a reserve sufficient to meet all expenses—including living—until the enterprise is established upon a paying basis (usually for a fairly long period), and the fowls have to bear all, or most, of the rent, labour and other charges, in addition to such costs of production as are inevitable under any conditions. Further, an outbreak of disease may at any time destroy the chief or only source of income. Farm poultry keeping is not similarly handicapped, as regards capital expenditure or costs, whilst the loss from epidemics is more easily avoidable, and the results of a possible outbreak far less crippling.

Penning arrangements, so far as they may be necessary on the farm, are much less elaborate and expensive than they must necessarily be on the poultry farm proper. The burden of rent is offset by the value of the manurial product on agricultural land. Feeding is very much less expensive, under ordinary good management. Further, investigators have found that the profit on capital employed is capable of being greater in the case of poultry than in connection with several other branches of production on farms. It has been shown, indeed, that in several instances the production of eggs and poultry has been the only consistently profitable branch. on a group of farms kept under observation, under the conditions that have prevailed recently.

Benefits to Cultivation.—The relation of poultry keeping to general farming, and fruit growing, was discussed in considerable detail at a conference held this year at the Harper Adams Agricultural College, and many extremely interesting facts were put forward in proof of the profitableness of fowls as an adjunct to cultivation. The benefits to the land and the growth of crops that result from the distribution of the nitrogenous manure deposited by the birds was clearly shown to be in itself amply sufficient to free the fowls from a charge for rent: whilst, in addition, the greater health and freedom from damage and disease of trees and plants, due directly to the destruction of pests of various kinds, is an increment of almost inestimable value. This holds good in respect to both fruit and farm crops. From the farming point of view, therefore, poultry under good management aid cultivation, altogether apart from the possible profit on their produce—and the margin of profit is widened by the economies of farm poultry keeping by comparison with those of poultry farming. In spite of these well-authenticated facts the agricultural land of the country is notoriously very greatly understocked with fowls, in relation to the number which it would carry without any interference with its other uses for stocking and cropping.

Food and Labour Costs.—Fowls kept on the general farm necessarily cost considerably less to feed than those that are kept by specialist egg farmers They have a very much larger proportionate range, and when distributed judiciously (as they must be in accordance with the method of cultivation) they find a large amount of natural food by foraging over pasture, arable (including stubble), and woodland. A great part of the food supplied, in addition to that which they find, is frequently grown on the farm that carries the fowls, including grain, green stuff, roots, clover hay, etc.; and, whilst meals must necessarily be obtained from the miller, the purchase of such mash ingredients as meat meal or fish meal may often be obviated by the availability of other and cheaper forms of flesh food.

The question of labour, however, requires much more particular consideration than it has usually received in the past in regard to farm poultry keeping. It is evident that if the fowls are to produce the highest possible return they must be put in charge of some particular person or persons possessed of sufficient special knowledge to manage them to the best advantage. This is obviously as true of the poultry department as it is of any other branch of live stock kept on the farm. It may or may not be a whole-time job. That is a matter that depends upon the circumstances of the individual farmer. If the operations are sufficiently extensive it should prove profitable to employ a properly trained poultry man or woman, or, as some large occupiers of agricultural land have done already, engage a gamekeeper to take control. Under some conditions it has been found most satisfactory to pay a bonus to one or more of the labourers with an aptitude for the work A farmer in the south-east who rears some thousands of table chickens annually pays his men threepence for each bird brought to a fattening age and condition. The same principle could be applied in some circumstances to egg production.

System Essential.—In any case it is essential to systematise the poultry work on the farm. and this necessitates the putting of some capable person in charge, with full responsibility for results, whether as a sole occupation or in conjunction with employment in other directions. although the opportunity for such other employment would in most cases be seasonal rather than regular This is, however. a matter for regulation to suit particular and individual needs; the main point is to ensure the responsibility of some person or persons, of ability equal to that of those in charge of the several kinds of bigger live stock. Given this ability, and the suitability of the stock, the better returns should much more than compensate for the relatively small addition to the cost of management.

The suitability of the stock is, of course, a vital factor. It is necessary to raise the level of quality of the fowls kept on, probably, the great majority of the farms in Great Britain. It is not only desirable to increase the head of stock on farms generally, but it is essential that farmers should keep the best birds only, to ensure the maximum individual output, whether of eggs or chickens. The lessons of milk recording may be applied equally well to this branch of production. Just as it pays better to own a few deep milkers than many more animals of average class, so also is it more remunerative to stock a smaller number of fowls of a prolific strain than several times the number of mediocre birds. The keeping of egg records is as economically important as the keeping of milk records; it is essential to maintain a good flock-average of production.

In the selection of breed, however, the main purpose of production must dominate the choice, but the farmer must bear in mind that the egg specialists have made considerable use of sitting breeds in making laying strains. This has resulted in some amount of breeding-out of the incubating instinct, and in the reduction of the table qualities of the strains of general purpose breeds that have came under this influence. The main purpose of the farmer may be egg production, but he usually requires at the same time a class of cockerel that will make a passable table bird. The farmer, too, is wont to depend upon the broody hen to hatch and rear, to a much greater extent than many other poultry keepers.

The level of production should be set at a reasonable height in relation to the type and general characteristics of the breed in question. For instance, a flock-average of 170 to 180 eggs per bird per annum would be excellent on the commercial egg farm, where egg production is the chief object: it would be higher than most—150 is probably nearer the average. But the attainment and maintenance of any such yield depends upon strain as well as breed, and if birds are expected to breed good table chickens as well as to produce a reasonable number of eggs the output of the latter must not be so developed as to detract from the suitability of the former. The yield of fowls kept under farm conditions may fall somewhat short of what is attainable under more artificial methods of management, but the costs of production are lower, and with a breed and strain capable of laying comparatively well in autumn and winter the average profit should be satisfactory. The general farmer will usually be well-advised to make choice of a general, or dual-purpose breed, and to make sure that the birds are of a type to justify the description.

Organisation of Marketing.—Finally, there is the question of marketing, and unless the present methods are altered efforts to increase and improve production will be very largely nullified. If poultry keeping is to be brought more generally into the scheme of farming, the marketing conditions and facilities must be so arranged that they give the required encouragement to enlarge the output. It is quite evident that the solution of the marketing problem is to be found in some method of co-operation sufficient to direct and control the system of distribution. It is here that farmers as a class have at least the nuclei of the required organisation already at their command, in the existing agricultural co-operative societies, a few of which have, indeed, established branches for the sale of eggs and poultry. Whatever method may be deemed best for the local purpose, the need for some central control of distribution—as recommended in the report of Lord Linlithgow's Committee—cannot be gainsaid.

That the generality of farm producers could do very much better than they have done hitherto is evident from the experience of those who have made the experiment of marketing upon a co-operative basis, as, for instance, in East Anglia. In Denmark, the most commonly quoted example of this form of co-operative endeavour, there is a central society which embraces about 540 affiliated local bodies of producers, and the success of their operations is a matter of common knowledge. There has also been a noteworthy development of the co-operative method of dealing with eggs in the United States of America; and, in short, it is the well-organised co-operation of our foreign competitors against which our home producers have to contend in their own home markets. They can no longer afford to ignore this economic weapon, which they must, perforce, adopt in defence of their own trade and its development. Farmers are better able than any others to put the required machinery in motion.

All the conditions combine to make the present time favourable to the development of egg and poultry production upon the general farms of Great Britain, and to the consolidation of the home producer's position in the home market. Here, at least, is one industry the retention and enlargement of which is within our grasp, and farmers are the only class in a position to seize the opportunity promptly and to meet the demand upon a big enough scale.

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NOTTINGHAM COUNTY EGG LAYING TRIALS.

J. A. CASEBY,
Small Live Stock Instructor, and
R. N. DOWLING, N.D.A.,
County Agricultural Organiser.

NOTTINGHAMSHIRE is a county that offers good prospects to commercial poultry keepers on both farm and small holding, for there are good markets close at hand and soil and climatic conditions are suitable. The number of poultry farms is comparatively small, but there are very large numbers of individuals who devote part of their time to poultry keeping and who look upon it as a business proposition. An account of the County Laying Tests which have been organised by the County Small Live Stock Instructor is of special interest as showing how such trials can be run on self-supporting lines without financial aid from the local authority or the Ministry.

Inquiries were made among poultry keepers in the county as to the possible support in the form of entries for competition that might result in the event of a County Egg Laying Station being set up, and it was soon evident that there would be no lack of competitors. As each would pay a proposed fee of £1, a fairly certain revenue from this source could be relied upon.

Then came the question of the necessary equipment, in the form of poultry houses, wire netting, posts, etc. A firm of poultry appliance manufacturers was approached with a proposal which, after consideration, its principals agreed to, namely, that they should provide practically the whole of the equipment on a loan basis, and that the county should have the option of taking it over at a price at some future date, should they so desire. This arrangement made it possible to proceed with the scheme.

The next step was to find a suitable centre and farm, with a reliable manager to carry on the work of feeding and general management, who would undertake this without payment beyond the proceeds of the sale of eggs.

Several possible centres were examined, and it was finally decided to establish the station on Mr. S. V. Playle's poultry farm at Mapperley, Nottingham. This farm is situated within easy access of Nottingham, and can be reached by tram from any of the railway stations in the city. The situation is a very exposed one, being some four hundred feet above sea level, windswept, and sloping to the north. The birds are therefore severely tested for stamina as well as egg production. The soil is a very heavy clay, and is of the Keuper Marl geological formation.

It was felt that whatever success was obtained under these conditions would prove beyond doubt the possibility of keeping poultry successfully anywhere in the county.

Equipment of Pen Section.—In the first test, 1921-22, there were 20 houses and runs and a large two-compartment hut used as a food store and office. In the second test, 1922-23, six extra houses and runs were put up to enable 26 pens to compete. The pen houses are of the Lancashire Cabin type and measure 6 ft. x 4 ft. x 5 ft. Each house has a floor raised on bricks, and six windows, the glass being removable. There are four nests and also a dropping board and one perch. The runs are 25 yd. by 6 yd. and each run has a gate opening on to the avenue. A metal water fountain and metal grit box hang on the outside of each house, and a V-shaped trough is used for the crumbly feed.

Equipment of Single Pullet Section.—The large hut used in 1921-22 as a food store and office was converted into a poultry house by putting an exit door for the fowls in the front of each compartment. Six trapnests were put in each half and also a dropping board and perch. There are four large windows in the hut, and the upper half of each window is hinged to allow for greater ventilation. The outside runs are 50 yd. by 12 yd. and about 20 pullets can be run in each of the two sections of this test. Mixed heavy breed pullets are in one half, and mixed light breeds in the other.

Management.—Mr. Playle has acted as manager and personally does the work of feeding and egg recording, and is responsible for the labour for cleaning and disinfecting the houses and watering the birds. The feeding in the morning is of warm crumbly mash, which is fed in troughs at dawn. The system of feeding on a well-balanced ration is carried out carefully. Each pullet gets as much mash as it requires, and heavy laying means more food consumed. The mash is composed of high-grade meals as follows :—

	Parts by weight.		*Parts by weight.*
Middlings	4	Fish, meat and bone mixed	1
Sussex ground oats	2	Dried yeast	1
Flaked cooked maize	1	Alfalfa	½
Biscuit scrap	1	Charcoal	⅛

A very small quantity of cod liver oil is added during east winds, frost or snow. Cabbage is given when the grass loses its nutrient value. The albumenoid ratio of the meal mixture is 1 to 3¼. This appears to be a rather narrow ratio, but it is

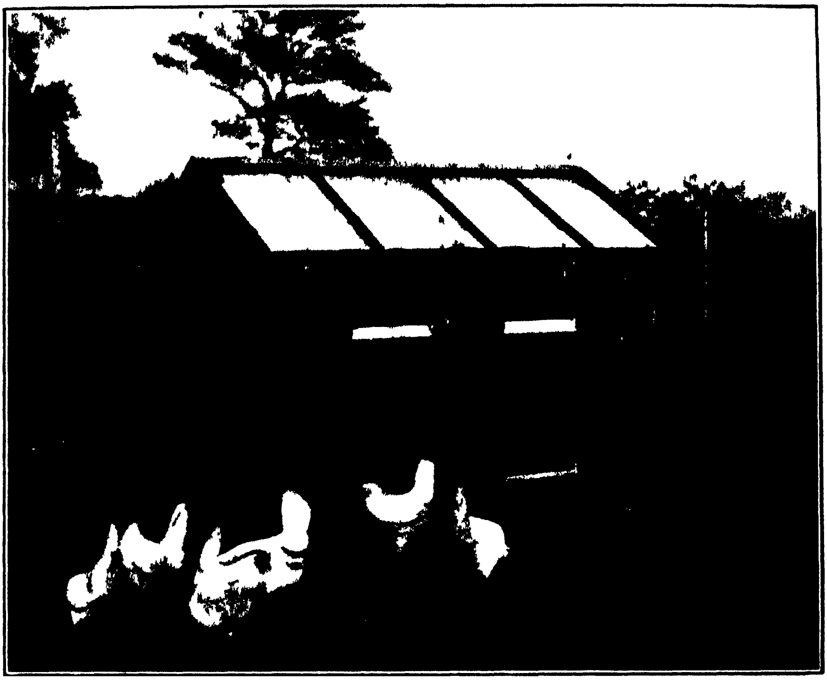

FIG. 1.—Type of House used at Nottingham County Egg Laying Trials. Runs 25 yd. × 6 yd.

FIG. 2.—Divided Poultry House with two large runs.

widened considerably when one takes the grain portion of the ration into account.

The afternoon feed is composed of sound cereals such as wheat, oats and cracked maize in rotation, buried in a good depth of chopped straw and chaff. The houses are cleaned out on alternate days, and the dropping board and perches lime-washed weekly. The water fountains are replenished daily, and the grit and shell added to the hoppers as required.

Egg collection is done as late as possible each day, to ensure getting all eggs laid that day and the number is recorded on the record sheet, and also the pen number on the egg. Broodies are removed to broody coops with a slatted bottom raised on legs. The broody pullets are fed and watered while shut up and returned as quickly as possible to the pen when it is seen that they stop "clucking."

The Objects of the Test.—These can be looked at from two standpoints: (1) That of the Nottinghamshire Education Committee, and (2) that of the individual competitor. Laying tests show farmers how it is possible to get paying numbers of eggs in winter. They act as demonstration centres (as many as 250 people have been at the Nottinghamshire test in one day). They are a guide to poultry keepers as to where the best laying strains are bred, and high-grade stock is distributed by them throughout the county.

Taking the competitor's standpoint we have the advertisement for his stock, the possibility of winning valuable prizes, and the profit from the sale of eggs.

With the following reservations the manager retains as his property all eggs laid. *The public* can purchase eggs for hatching from, say, the leading pen at 15s. per doz. when eggs are, say, 2s. 6d. retail; *the owner* of the pen receives the 15s. less the retail consumption price which the manager receives, and 6d. per doz. which the Education Committee receives. *A competitor* can purchase eggs from his own pen at retail consumption price plus 6d. per dozen. *The manager* can set for hatching any eggs not disposed of, but he cannot sell sittings except officially as described.

Methods of Scoring, Entry Fees, etc.—The pen section is composed of entries of 6 pullets in each pen, and one competitor can only enter one pen. Any breed or first cross is allowed to compete. All competitors must reside in the administrative county of Nottingham and must certify that they reared the pullets on their own premises.

The pen section is not trap-nested but simply scores on total number and weight of eggs produced. The margin of error is negligible, as eggs laid on the dropping board, in the litter or in the run are recorded. Shell-less eggs as well as double-yolked or very small ones all go into the score. If an egg is fit to eat it is fit to be added to the score. Small eggs are handicapped not by being ruled out altogether, but by having a much lower total weight. Weight, not number, counts in the final score, and it has happened that the sixth pen actually laid more eggs than the second pen.

In the single pullet section (heavy and light breeds) all pullets are trap-nested and the records are of course not so accurate owing to a very few unrecorded eggs laid in the litter. Scoring in this section is also by total weight.

The entry fees are fairly low so that small poultry farms or private individuals can be represented. £1 per pen of 6 pullets and 4s. per pullet in the single section is within the reach of all. Competitors may send a cockerel to the test in January to mate to their pullets, and can then obtain eggs for hatching as indicated above. A charge of 3d. per week for cockerels is made to cover food costs.

It will be seen that the tests demonstrate breeding value and stamina as well as the capacity to lay under adverse conditions. Eggs set from the first position pen in both tests have proved to be of high hatching quality and the chickens have reared well. The manager finds all foods, litter, etc., at his own cost. He also gives the land and labour. The Nottinghamshire Education Committee receives the entry fees and 6d. on each dozen eggs sold for hatching. In the first test about £24 was received by the Committee and in the second test about £36.

Class of Competitor and Breeds entered.—In the first test, 1921-22, there were five pens of White Wyandottes, six pens of White Leghorns, three of Rhode Island Reds, two of Black Leghorns, one each of Buff Orpingtons, Croad Langshans, Anconas and Light Sussex. Six competitors run from 250 head of poultry each. Nine run from 100 to 150 head and the remaining five were backyard poultry keepers with up to 40 head. Nine of the competitors were women and eleven were men. The second test, 1922-23, with 26 pens, included nine pens of White Wyandottes, eight pens of White Leghorns, three of Rhode Island Reds, two of Light Sussex, one each of Black Leghorns, Buff Orpingtons, Sicilian Buttercups and a first-cross Wyandotte-Rhode Island Red. The competitors were owners of flocks of approximately 200 head, except one egg farm and four backyard poultry keepers. Seven of the 26 competitors were women.

Result of the Tests.—The total number of pullets competing in the first test (1921-22) was 120, and the egg yield from 1st November to 30th April, was 12,394 The average per pullet was 103 and the deaths amounted to three. In the second test (1922-23), there were 193 pullets. The total egg yield was 15,514 eggs. As the second test started on 1st October, 1922, instead of on 1st November as in the previous year, the average per pullet is less,—October, a lower production month, being included, and April, a high production month, being excluded. The average per pullet was 82 eggs. The deaths amounted to seven, but two of these were killed by either a fox or a dog breaking into a pen. The tests have both been quite free from infectious disease, all deaths from disease being caused by ovary trouble.

Considerable numbers of eggs were taken from the mated pens by the owners for incubation, and the hatching results in most cases were excellent. The sales of eggs to outside poultry keepers were small owing to the price charged for eggs from the leading pens being high for most people. The idea that it is not advisable to breed from high production pullets, which is generally accepted, has been disproved by the reports of high hatchability and high rearing results. In one case fifty-three chicks hatched out of sixty eggs from the leading pen and almost all were reared.

Comparison of Breeds in both Tests.—Rhode Island Reds won the first test with 766 eggs weighing 96 lb. 6 oz. This gives an average per pullet of 127 eggs. White Leghorns won the second winter's test with 649 eggs weighing 77 lb. 15½ oz. The average per pullet was 108 eggs. By comparing the results of the leading pen in both tests for November, December and January (12 weeks) we get the following:—1st Test, Rhode Island Reds, 362 eggs. 2nd Test, White Leghorns, 308 eggs.

Prizes.—Three silver medals and four bronze medals, and certificates of merit, are awarded to the best pens.

Cost of Feeding.—The cost to feed each pullet works out at 2¾d. per week. The mash cost 15s. 6d. per cwt. and the grain 11s. per cwt., and 1 lb. of each is consumed per week. The high production pens take more, but in others very little is eaten when partial moult, broodiness, or resting is going on.

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SECURITY OF TENURE FOR ALLOTMENT HOLDERS.

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THE article which appeared in the August issue of this *Journal,* entitled " Permanent Allotments : Security of Tenure and How to Obtain It " was of considerable interest in drawing attention to a subject which is arousing a great amount of discussion among allotment holders at the present time. The problem of security of tenure is a burning question with those who cultivate allotments in their spare time. The Report of the Departmental Committee on Allotments, 1922, contains the following passage :—" The evidence we have received from the representatives of the allotment holders has been unanimous as indicating a keen desire for security of tenure. It is obvious that the cultivators of allotments will be more likely to make greater use of their land and much better cultivation and increased production will result if security of tenure is made possible. In order that such security may be given, however, it is necessary that land should be purchased by the Local Authority or by an Allotments Association."

In order to meet the situation, the Committee recommended that local authorities should purchase land for allotments wherever practicable within, or on the outskirts of the towns, and that co-operative allotment associations should be empowered to obtain loans for the purchase of land from the Public Works Loan Commissioners.

As regards the first of these recommendations a condition militating against its adoption is the fact (in the words of the Committee's Report) that " in the large cities and towns it is probable that the capital value of land within reasonable access of the homes of persons who desire to cultivate allotments, is so high as to prevent the purchase of land by Local Authorities, if a condition precedent to the acquisition is the payment of economic rents by the plot holders." Under existing legislation, a local authority is required to make its allotments undertaking self-supporting, except that expenses of acquisition, of making public roads, and sinking fund charges in respect of loans raised in connection with the purchase of land need not be taken into account. It is, of course, true that if land is purchased at a high figure, the rent which the local authority will be obliged to charge to the plot holders will be correspondingly high, but it is a matter for careful consideration by the allotment holders themselves whether a higher rent is not more than justified in consideration of the advantages which accrue to the plot holders in obtaining security of tenure.

Hiring versus Purchase.—To illustrate the point, let it be supposed that an urban authority are faced with two alternatives: (1) *hiring* for allotment gardens land with a present, or prospective building value, or (2) *purchasing outright*. Under the terms of hiring, the owner would doubtless be entitled to re-enter and end the local authority's tenancy at any time after three months previous notice in writing if the land were required for building, mining or other industrial purposes, or for roads or sewers necessary in connection with any of those purposes. The allotment holders would therefore be liable to be turned off their plots at any time during the year after three months notice, although it is true they would be entitled to compensation for the crops growing on the land in the ordinary course of cultivation of the land as allotments and for manure applied to the land. The rent payable by the local authority to the landlord might be anything from £3 to £8 an acre, the higher figure being payable where the land had an accommodation value owing to its proximity to a large city or town. Assuming that the rent were fixed at £8 an acre and the local authority added say 10 per cent. for administrative expenses, management, bad debts, unlet plots, etc., the rent payable by the allotment holders would be £8 16s. an acre. Each acre may be expected to provide 15 plots of 10 rods each, after making allowance for paths, and the rent of a 10-rod allotment would therefore work out at approximately 12s. per annum.

As an alternative to hiring, let it be supposed that the local authority could purchase the land outright for £300 per acre. A loan could in all probability be obtained from the Public Works Loan Commissioners in respect of the purchase money, the repayment to be spread over a period of 80 years, the rate of interest current at the present time (October, 1923), being 4¾ per cent. The loan charges in respect of a loan of £300 would be £14 11s. 10d. per annum, including repayment of principal, and adding the same amount for administration as in the case of hiring, namely, 16s. per acre, the rent which the local authority would have to charge to the plot holders excluding repayment of principal would be approximately £15 per acre or £1 per plot of 10 rods—a difference of only 8s. per annum per plot as compared with the 12s. rent if the land were hired.

The point for consideration by plot holders generally, is whether the fact that security of tenure could be obtained by the payment of an additional rent of 8s. per plot annually, would not justify a large extension of the provision of allotments on a permanent basis by means of purchase of the land by a local authority. There seems considerable force in the contention that the advantages which the plot holder would enjoy under conditions which would enable him to feel absolutely secure in his tenancy so long as he paid his rent and cultivated his plot properly, are well worth the additional annual payment.

It should be remembered in this connection that the amount of rent payable by a plot holder for his allotment is, after all, the smallest contribution he makes towards the cost of producing his crops. The purchase of seeds and manures, is, of course, an important consideration, but the really heavy item to be considered in the production of crops on an allotment is the allotment holder's labour. This labour is, however, given in his spare time, and is really a recreation, and is labour for which he has no market. It is submitted that the value of the crops produced from a 10-rod allotment under normal conditions and with an ordinary amount of skill on the part of the cultivator is such that a payment of 8s. per annum in the nature of rent is really a very small item. Under the system where the plot holder has security of tenure he can cultivate his plot without risk of disturbance; he is encouraged to plant crops, fruit bushes, trees, etc., which continue productive for more than one year; he is more likely to erect a permanent and attractive shed for his tools, etc., and in all probability to beautify his allotment with the addition of a few flowers which, without reducing materially the food productivity of his plot would make it more attractive as a feature of the landscape.

It may be explained that in comparing the two alternatives of purchasing or hiring land for allotments, the cost of erecting any necessary fencing, providing water supply, making paths, and such items, may be disregarded, as such expenditure will be common to either scheme; but where land is purchased with resulting security of tenure for the allotment holders, it is obvious that there is wider scope for the carrying out of more or less permanent improvements, and a certainty that the allotment holders will reap the full reward of any such expenditure.

Loans to Associations.—With regard to the second recommendation made by the Departmental Committee as to loans being granted by the Public Works Loan Commissioners to

Co-operative Allotment Associations, it was not considered practical for effect to be given to the recommendations in the recent Allotments Act of 1922 for the reason that money was not available for the purpose at the time of the passing of the Act. In view of this it is desirable to consider whether loans from the State *direct* to a society are a necessary corollary to the purchase of land for allotments by such associations. A particular case, as described in the article in the August issue of this *Journal*, would appear to indicate that direct loans by the State are not essential where the instinct of co-operative self-help is already sufficiently developed amongst the members of an allotment association, and particulars of other cases, which are given below, of societies which have actually arranged the purchase of land for allotments, appear to indicate that given the necessary ability and energy on the part of the plot holders and the officers of an association. there is no reason why a considerable extension of the purchase movement should not take place.

Warley Freeholders, Limited.—In the Warley district, on the outskirts of Birmingham and lying between Oldbury and Smethwick, about 12½ acres of land had been provided for allotments by the local authority under the Defence of the Realm Regulations. The tenants realised, however, that as the land had been provided under emergency war legislation there could be no security of tenure, and in 1919 they approached the local authority and asked them to purchase the land so that it could be let under more permanent conditions. The local authority could not see their way to purchase the land and the tenants then approached the owners direct with the result that the land with three cottages was offered to them for £2,700. It was decided to accept this offer and the allotment holders formed themselves into the Warley Freeholders, Limited, a Society registered under the Industrial and Provident Societies Act and affiliated to the Agricultural Organisation Society, the Secretary of the Society being Mr. R. C. Woodward. One of the members, Mr. J. E. Taylor, lent the Society all the purchase money at 4 per cent. interest free of income tax, and it is doubtful whether the scheme could have been carried through without an advance on such favourable terms. Each member was required to become a shareholder and pay at least £5, following this with periodical payments until he held shares to the value of the plot he wished to purchase. A call on the members resulted in a payment of £537 15s. by the 31st May, 1919. This enabled matters to proceed. The next step was to get the balance of the borrowed money from the members. They paid as much as they were able on the pay nights, the minimum being 10s. every four weeks. By the 30th September, 1920, no less than £1,000 had been paid off, and a year later on the same date this had been increased by £490. At the annual meeting the members decided to inaugurate a "mutual scheme" to endeavour to finish the matter as owing to unemployment and other causes a few members were transferring their shares.

The plan arranged was that the front portion of the land should be sold for building purposes and that the cottages also should be sold. The rear portion of the land, about 8 acres, was sold as allotments to member shareholders of the society and only eight shareholders were repaid their share capital in lieu of taking up land, the remaining 90 members allowing their money, which they had already paid in, to remain as payment for land allotted to them. The scheme was a financial success and after all expenses had been paid, interest at the rate of 5 per cent., amounting in all to £202 8s. 9d., was paid on share capital from the start and a surplus of £329 7s. 6d. was returned to the shareholders at the rate of £3 17s. 6d. for each full share. The late shareholders own the plots on condition that no houses shall be erected and that the ground remains as allotments. By co-operative methods security of tenure has been obtained and an open space under garden cultivation has been permanently secured.

Witton and District Allotments, Limited.—A further example is that of the Witton and District Allotments, Limited. In this case an area of land comprising 80½ acres was under cultivation as allotments by the society when it was purchased by Farrow's Bank. It was valued in the Bank's assets at £25,000, but when the Bank went into liquidation the society was successful in purchasing from the Official Receiver for £7,000. The society, which was duly registered and affiliated to the Agricultural Organisation Society, purchased, in addition to the land, a farm house and farm buildings for the sum of £1,500. Possession of the house has not yet been obtained, but the farm buildings have been utilised for the purpose of a social club, the farm yard being converted into a bowling green; the barn into a lecture and concert room; the cowshed into a games room with a billiard table, and the cartshed into a refreshment room, ladies room and office.

There are some 800 plot holders and a further 100 persons are members only of the social club. Each plot holder pays a membership subscription of 2s. 6d. plus 8d. for a card annually, together with 10s. rent for his plot, averaging 300 sq. yd. Social members pay 1s. per quarter. The society were fortunate in raising £6,000 from a Bank at 5 per cent. interest. Each plot holder is required to take at least one £1 share, but it is expected that each should become a shareholder to the value of £5, shares being payable by instalments if desired, the maximum amount which any member may invest in the society being £200. It is hoped that the borrowed money will be paid off in two years. An effort is being made to raise 1s. per member per week during this period, and it is anticipated that this, with the profits of the club (which is fully licensed and which has a turnover of £100 per week), will produce the necessary money in that time. Another source of income will be the selling of the frontage land in building plots.

Kidderminster.—Another example may be quoted of land at Chester Road, Kidderminster. In this case 12 acres of land were purchased for £2,350, and after allowing for cartways was divided into about 90 plots of 600 sq. yd. each. The price fixed for the plots varied from 2s. per sq. yd. for building land adjoining the roadway down to 7d. per sq. yd. for the back land. In order to obtain ready money, purchasers of the building plots were required to pay a deposit of £10 and others £5, the balance to be paid off at the rate of £1 per month. A society, known as the Chester Road Land Society, was formed. The first meeting for the paying of instalments was held in

October, 1920, when no less than £609 was paid in by the members. The men took possession of their plots on 1st November of that year, and by 31st December another £600 had been collected, the remainder of the purchase money being borrowed from the Bank. By February, 1923, only six members out of about 80 had not completed payments, and there was a balance at the Bank. Water has been laid on at a cost of £125, and this expense and upkeep of roadways, etc., has been paid off. The building plots have already appreciated in value. Mr. A. H. Weavers, of Kidderminster, who was mainly responsible for the original scheme, has carried out a similar scheme at Offmore Lane, where 42 plots of approximately 600 sq. yd. each have been purchased by the members of the Offmore Land Society.

Beckenham Allotments.—Another instance is the Beckenham and District Allotments Society, Limited, who purchased in 1921 some 2 acres of land at a cost of £92 10s. per acre, including all legal expenses. This land has been cut up into 30 10-rod plots, a standard rent of 1s. per rod being charged, bringing in £15 per year, out of which the society pay £5 for road and upkeep, leaving approximately about £10 per annum for the repayment of loans, which it is expected will be paid off in 19 years. Each member taking up a plot is required to lend to the society a minimum of £1 and maximum of £5, free of interest, repayable at three months notice.

North Mitcham Allotments.—Another instance of co-operation in practice is afforded by the North Mitcham Improvement Association's scheme. The main feature of the scheme is that while there was co-operative bargaining without liability, when agreement was reached as to details it was possible to secure individual payment and contract. From a local landowner a verbal option was secured on 7 acres of "back" land which had been used for allotments during the war and was not convenient for sports purposes. With the aid of the general fund of the new local association, a meeting was advertised for the purpose of discussing the scheme, and the support was sufficient to allow the acceptance of names of prospective purchasers. A local surveyor voluntarily prepared a plan which allowed for 92 10-rod plots with 10 ft. roads for approaching each. The price per plot was £20, with £5 to provide for roads and fencing, and restrictions were placed on building. The landowner agreed to accept £1,840 for the land and to take payment by instalments from 60 per cent. of the purchasers, the vendor's solicitors collecting the purchase price of each plot, whether paid in one sum or by instalments, and also the £5 per plot for development, in respect of which they acted as bankers. The solicitors on both sides charged merely nominal fees. The roads were vested in trustees appointed by the plot owners. The advantages of the scheme of permanent allotments are evident; the effects of ownership are seen in the succession of first-rate crops which have since been grown.

It will be seen from the particulars given above that there is a wide scope for variety in the details of schemes for the purchase of land for allotments, and the circumstances of any particular case may bring forth difficulties which will have to be overcome. On the other hand, experience may prove that in other cases difficulties will be less. For instance, it may be found that owners of land will be agreeable, when selling land to allotment associations, to allow a considerable proportion of the purchase money to remain on mortgage, thus reducing the amount of capital to be provided, in the first instance, by the members of the association. Moreover, where part of the land purchased has an immediate building value, the selling off of the frontage land makes the retention of the remainder of the allotments an easier financial proposition. Similarly, in the acquisition of land, part of which has a potential building value, the scheme might partake of the nature of a building development scheme hand in hand with the provision of allotments on the back land. In any such case, the important point which has to be borne in mind is that the main object of the scheme, namely, the provision of allotments to be utilised as such on a permanent basis, can only be achieved if conditions are imposed laying down clearly that the land shall remain under allotments in perpetuity; and where an association sells plots on the "allotment" portion to its members it seems desirable that restrictions should be imposed as regards building, as otherwise the main object of the scheme might be defeated.

It may be stated as an axiom that co-operative effort on the part of either an association or individuals, both in the direction of forming an association and carrying on the administrative work, the provision of labour for erecting fences, making paths, etc., is essential if the cost of the scheme is to be kept within reasonable limits. In the past, would-be plot holders have usually looked to the local authority to do practically all the work, whether in regard to provision of land, or administration, equipment, etc. The cost of all such work, however, has had to be recovered from the allotment holders in the form of rent, with the result that complaints have been made of the high rents charged. But with co-operative effort on the part of all concerned—the local authorities, allotment associations, and individual allotment holders—there seems no reason why the purchase of land for allotments with the resulting security of tenure should not be largely extended.

The writer is indebted to Mr. R. C. Woodward for information as to Warley Freeholders, Ltd., to Mr. Albert H. Weavers as to the Kidderminster schemes, and to Mr. A. W. Burgess as to the North Mitcham Improvement Association, Ltd.

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YOUNG FARMERS' CLUBS.

MISS E. H. PRATT, O.B.E., B.A.,
Inspector, Ministry of Agriculture and Fisheries.

Origin.—The Young Farmers' Clubs movement had its origin in America, and Farmers' Bulletin No. 385, issued in 1910 by the U.S.A. Department of Agriculture, suggests that it began, under the auspices of the College of Agriculture of Cornell University, as a development from nature-study lessons. By 1910 the Cornell Farm Boys' and Girls' Clubs had an aggregate membership of about 75,000, and the Cornell Rural School Leaflet, through which the movement was largely directed, was distributed to about 7,000 teachers and school commissioners. Similar progress was made in other States, and in 1912 the Federal Department of Agriculture supplemented State aid by a grant of 4,600 dollars. Federal financial support has not only been maintained, but steadily increased and reached, in round figures, 105,000 dollars in the year 1920-21.

The necessity for increased food production stimulated this movement during the War, and at the present time the development of Boys' and Girls' Agricultural Clubs forms an important part of what is know as "Co-operative Extension Work in Agriculture and Home Economics" in the United States. The U.S.A. Department of Agriculture and the 33 State Colleges of Agriculture co-operate in this work, which is carried on through a very complete county organisation, including provision for the furtherance of the club system. This form of practical agricultural education for young people is therefore part of a larger whole, and boys and girls appear to be participating increasingly with adults in carrying out common programmes of work. The fact that in 1920 5,043 standard clubs existed in the U.S.A., and that over 8,000 "Community programmes" (embodying special farm and home interests of men and women, boys and girls in a given locality) were developed, shows the extent to which the agricultural pursuits of the present and the rising generation have already been identified. More than 700,000 children are now enrolled in these clubs, and some idea of their activity may be gained from the fact that during the War they produced food to the value of no less than 20,000 000 dollars in a year.

Young Farmers' Clubs were instituted, on similar lines, in Canada in 1913 At the present time there are over 35,000 club members in the Province of Manitoba alone. and considerable developments are reported in Alberta, Saskatchewan, Ontario and British Columbia.

Development in England.—The first Young Farmers' Club in this country was founded in 1921 at Hemyock, Devon, by the United Dairies, Ltd., the objects in view being the production of cleaner milk and the introduction of a heavier milking breed into the district. The fact that the club now numbers 150 Associate Members amongst local farmers, that four of the members have attended courses at Seale-Hayne College, and that other clubs are to be established, is some indication of the nature of the influence exerted on farming methods in the neighbourhood. There are now 37 clubs in England and Wales, with a membership of over 600, and there is every likelihood of considerable expansion in the near future. The existing undertakings include the rearing of calves, pigs, poultry and rabbits, bee-keeping and horticultural production. The movement in England has been carried on under the ægis of the *Daily Mail*, which was also responsible for the formation, in 1921. of the International Federation of Young Farmers' Clubs, by means of which English, Canadian and American clubs have been brought into close touch. American young farmers have visited this country, and, as a result of the enterprise of the *Daily Mail* and the generosity of the Canadian railways, 4 boys and 4 girls, selected from Young Farmers' Clubs over here by representatives of the Board of Education, Ministry of Agriculture and the National Farmers' Union, have enjoyed an educational holiday in Canada this summer. The International Federation of Young Farmers' Clubs has received inquiries from Argentina, Africa, Australia, Holland, Sweden and Russia, and interest in the movement is evidently world-wide.

Purpose, Value and Possibilities.—The primary object of the movement is improvement in the quality and quantity of foodstuffs, but it is certain that other important results are also secured. Club membership constitutes a most effective training not only in farm practice but in business methods and in social intercourse. It is a valuable form of both general and agricultural education, for it tends to evoke and increase intelligent and sympathetic appreciation of every phase of rural life. Young farmers, brought into actual contact with current agricultural problems, and provided with the latest scientific suggestions for their solution, are likely to acquire an abiding interest in the development of the industry on the most approved modern lines.

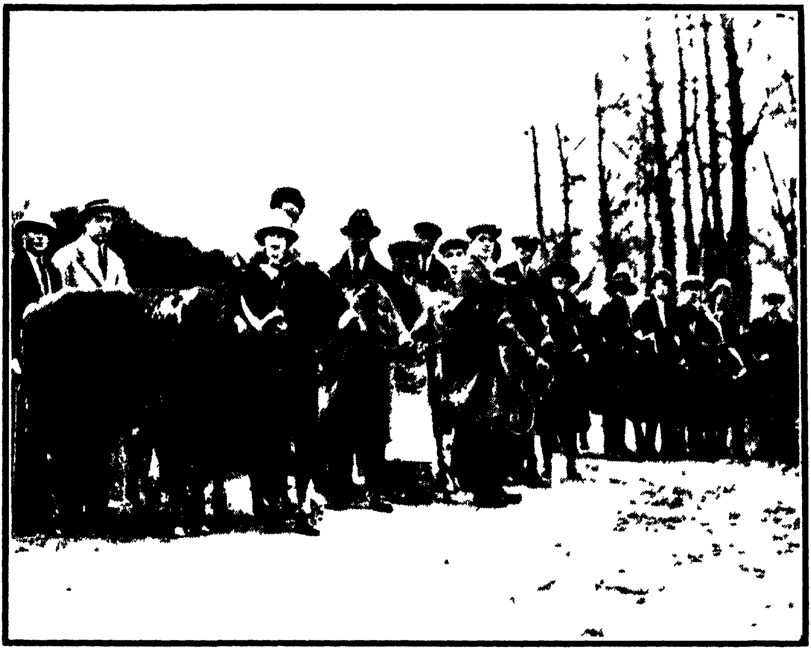

FIG 1—United Dairies Ltd Calf Club Hemyock January 1922
Members with yearling heifer calves

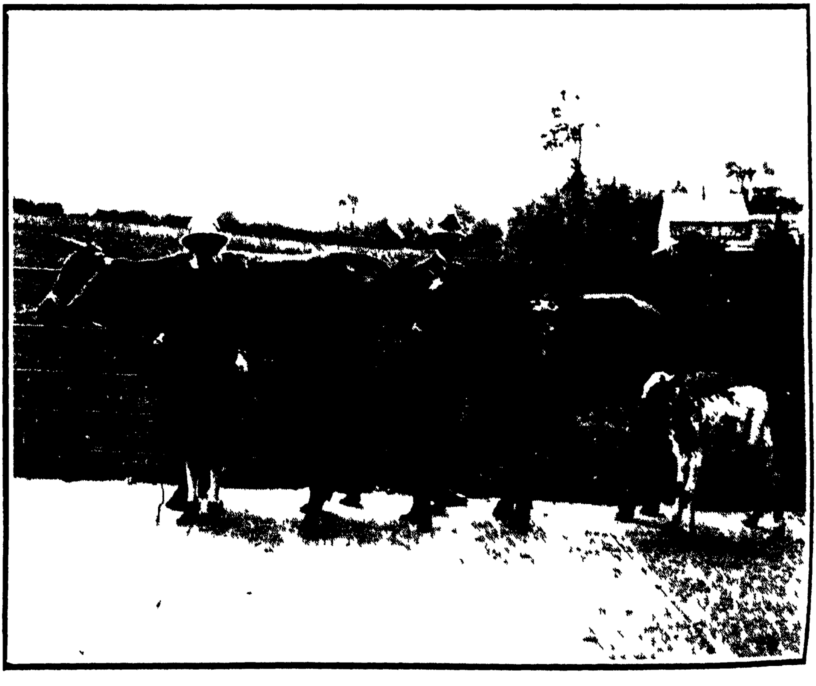

FIG 2—Doris Fry, United Dairies Calf Club, Hemyock No 1, with her 1921 heifer with calf, her 1922 yearling and her 1923 calf

That increased demand for entry to agricultural institutions results from the educational stimulus provided by these agricultural clubs has already been demonstrated in England, and this is confirmatory of the experience of the United States. Initiation into business management at an early age is invaluable, and the control of the affairs of the club also provides opportunity for the development and exercise of those qualities which are the foundation of useful and successful public work. Viewed in this way club membership appears as a continuation of education and a preparation for practical affairs.

Assistance for Young Farmers' Clubs.—It is evident that the movement is of national importance and that the effects are likely to be as far-reaching as those resulting from such other organisations of the time as the Boy Scouts and Girl Guides. The Scheme has been fortunate enough to enjoy, from the outset, the support of the *Daily Mail*, and it is being increasingly patronised by breed societies and industrial firms. The National Farmers' Union is desirous of establishing close relations with the movement and it has been suggested that members of Young Farmers' Clubs might be enrolled as junior members of the National Farmers' Union branches. Nor is the interest of Government Departments lacking, for the Board of Education and the Ministry of Agriculture are anxious to give every form of encouragement in their power. The foundation for work of this kind exists in the "rural bias" which the Board of Education encourages in suitable elementary and secondary schools, and of which details are available in the publications of the Board. The practical management of small livestock in connection with the teaching of rural science in elementary schools is an interesting feature. The Ministry, through its Divisional Inspectorate, is able to give much direct assistance, and has promised to use its influence with agricultural training and research institutions with a view to facilitating provision of lectures and dissemination of information. Local Educational Authorities also are becoming increasingly aware of the possibilities of the movement, and are in most cases willing to lend the services of suitable members of their staff There is every probability that, as in the United States, the connection between schools, local agricultural education and club organisation will become increasingly close. Officers of the Ministry of Agriculture and of the Board of Education may in their discretion do anything consistent with their official responsibilities towards furthering this movement.

Formation and Organisation of Clubs.—Those who are concerned with the furtherance of agricultural education and who may have opportunities of promoting the establishment of Young Farmers' Clubs in suitable localities will be interested in the procedure which has been followed hitherto.

A decision having been arrived at as to the kind of produce or stock which can be dealt with most suitably in the neighbourhood, a patron is secured, who will bear the initial expenses, and a small advisory committee of experienced and energetic helpers is set up. This Committee invites the young people of the neighbourhood and their parents to a meeting at which the project is outlined and club management explained. From ten to twenty of the children present (ranging between 10 and 18 years of age) then form themselves into a club, which chooses its own officers and regulates its own affairs.

With the fund supplied by the patron, or founder of the club, stock is purchased, judged and allotted by ballot to the members —a note of hand, signed by the member and backed by the parents being taken in exchange. At the end of a stated period (varying with the nature of the stock), during which inspections are made by the advisory committee, the stock is re-judged and prizes given for progress made and records kept. The animals are subsequently auctioned, the amount of original value repaid to the patron and the balance handed to the member concerned. Slight variations from this plan obtain in the case of, *e.g.*, crop-raising clubs, but detailed information is obtainable from the Secretary, Young Farmers' Clubs, the *Daily Mail*.

At the weekly or fortnightly meetings of the club, lectures are given or discussions held. Associate Members, who have no voting power and for whom there is no age limit, are entitled to attend these meetings.

With the continued growth of the movement variations of existing methods of instituting and maintaining the clubs will suggest themselves. The establishment of contact with other rural organisations will open up new possibilities. The sympathy of country women for instance might be secured through the Women's Institutes, and the interest of officials of agricultural societies would assist in bringing the whole scheme more prominently to general notice in the showyard and elsewhere. The movement is certainly well founded already, but deserves even wider public recognition than it enjoys at present.

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BLACK AND RED CURRANTS.

BLACK CURRANTS.[*]—In consequence of the losses caused by big bud, running off, and reversion, large areas of black currants have been grubbed and replanted to other crops, so that the present home production falls short of the demand, and good market prices prevail for the fruit. Though these troubles are of a serious nature, it is possible to produce satisfactory crops by planting none but true and healthy stocks of varieties suitable to the soil and district, and by exercising special care in controlling the spread of big bud and reversion, and in carrying out suitable cultural and pruning operations, which, with the aid of sufficient and suitable manures, will encourage the bushes to develop strong and healthy new shoots annually. The size of crop produced is largely influenced by the character of the soil and other conditions, and by the care and treatment given to the plants. The weight per acre may vary from 7 cwt. to 2 tons, or even more where conditions have been extremely favourable. Where experiments have been carried out the records show, however, that the crop generally averages under 1 ton to the acre. For instance, Dyer and Shrivell, in their experiments at Tonbridge for eight seasons, obtained crops varying from 15 cwt. per acre where 25 tons of London dung were used as manure, to 7 cwt. per acre where only phosphates and nitrate of soda were used. At East Malling during 1917, 1918 and 1919 the records indicate that an acre of " French " (1,210 bushes to the acre) might be expected to yield a crop varying from 17.4 cwt. to 4 cwt. Similarly, " Boskoop Giant " varied from 16 cwt. to 6 cwt.; " Victoria " from 14 cwt. to 4 cwt. and " Baldwin " from 26.8 cwt. to 18.8 cwt., according to the manurial treatment adopted. It appears that within each variety there exist strains of high productivity.

Propagation.—It is evident, therefore, that trials are necessary to ascertain the varieties which are best suited to the local conditions, after which further developments may be made by planting purchased bushes or bushes which can be propagated at home from cuttings. Before purchasing it should be ascertained that the bushes are true to name, free from rogues, big bud disease and reversion. The bushes may, however, be propagated at home from cuttings (*i.e.*, vigorous, well-matured young shoots, 10 in. in length) taken from bushes; but it is of the greatest importance that the cuttings be taken only from bushes known to be free from big bud disease and reversion.

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[*] See also Black Currant Growing in Norfolk, by H. Goude ; this *Journal*, April, 1923, p. 62.

Cuttings should be taken in October or November. They should be of substantial thickness and about 10 in. long with all the buds on, so that the bushes are not grown on a leg. The best growth is made if cuttings are planted on the same day that they are cut off the parent bush. The ground should be well prepared for planting and the cuttings should be put in 6 in. apart in rows 2¼ ft. apart against the side of a furrow or notch at a depth that permits two or three buds to project above the soil level. The soil is returned—on stiff soils not more than 2 in. at a time—and carefully trodden down. During the following spring and summer the surface of the soil should be kept moved to conserve moisture, and prevent the growth of weeds. The bushes should be fit to plant out at one year old.

A description of a method adopted in Norfolk for raising clean plants from spring cuttings was fully described in the August, 1921, issue of this *Journal*, p. 460.

Planting.—Black currants grow satisfactorily in varied types of soils, ranging from heavy loams to light sand, always providing that the texture permits of free rooting and that an adequate supply of moisture can be obtained. The site of the land should be both warm and sheltered, under which conditions insect life is more abundant and pollination facilitated. This is particularly important in the case of those varieties bearing flowers with the stigma projecting beyond the anthers, for in this case many of the flowers fail to become fertilised by natural processes, and there is a consequent poor set.

Before planting, the land should be well manured, and cultivated to a depth of at least 12 in. (deeper if there is a hard pan below). In practice this is preferably done for the previous crop, though further deep cultivation should be given to bring the land into a suitable condition for planting. The bushes are usually planted at 6 ft. square, though Baldwin varieties may be only from 4 ft. to 5 ft. apart. In some districts it is believed that better results can be obtained by planting bushes very much closer together.

The planting should take place preferably during the autumn, though it can be done in January and February. At the time of planting, or soon after, all growth should be cut to within two buds of the base.

Cultivation and Manuring.—After planting the land must be kept clean, free from weeds, and in a loose friable condition at the surface. In practice this is accomplished by shallow digging or ploughing up to the bushes in the winter, followed by spring and summer cultivation.

Near the bushes the digging, ploughing and cultivation should be shallow to avoid harm being done to the masses of fibrous roots.

Whilst black currants benefit from repeated applications of manure, experiments by Dyer and Shrivell, and by Hatton at East Malling, indicate that the crop is not equally responsive to all classes of manure. Farmyard manure appears the most suitable and liberal supplies of this should be given. Fish, meat and bone meal and shoddy are often used in both Kent and Norfolk in conjunction with smaller supplies of farmyard manure. The crop does not, however, seem always to respond to dressings of artificial manures. Summer mulches with farmyard manure, reeds, or spent hops prove beneficial.

Pruning.—In the winter following the planting, all the bushes that have made three or more growths at least 2 ft. long should have the weakest shoots cut back to two buds. All the shoots of the less vigorous bushes should be cut back to two buds at the base.

In later years, with older bushes, the shoots are not shortened but the bush thinned by removing the less vigorous branches each year. This encourages the development of new shoots, on which the black currant fruits best.

Though not properly forming a part of pruning operations, it is essential that the measures for the control of the big bud mite* should be carefully observed. Branches which show reversion† must be cut out, and in some cases whole bushes grubbed.

Varieties.—In a short article it is only possible to deal with such varieties as are commonly grown for market. The characters most useful for determining black currants are possibly the habit of growth of the bush, and the colour and shape of the buds and bud scales, which characters are more apparent during the winter months. There are other points of importance that help to distinguish one variety from another, such as:—The period of breaking into leaf—early with Baldwin and late with Boskoop; the size of the leaf as a whole; the shape of the central and lateral lobes; the depth of indentation where the lobes meet, and the indentation at the base by the leaf stalk; the leaf serration. The blossoms have individual points of difference; the length of each raceme (chain) varies from "long" in the case of Boskoop to "short" in the Victoria group. Boskoop frequently has single racemes springing from a spur, whereas three to six are common in the Victoria group. The fruit, which is of most importance to the grower, exhibits certain differences in size, flavour, and skin toughness, and these will be considered, but generally these distinctions are less dependable than those of the bush, leaf, and blossom.

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* *See* Leaflet No. 1 (*Black Currant Mite*).

† *See* Leaflet No. 377 (*Reversion or "Nettlehead" of Black Currants*).

The descriptions of the varieties are as follows:—

GROUP I.—FRENCH TYPE.—Bush and Leaves.—Very large, much branched bush, very compact. Moderately strong and quick grower. The buds are pink to deep red in colour, of medium size, conical shape, pointed at the apex, and somewhat tightly wrapped with bud scales. The leaves are of medium size and are pointed, *i.e.*, the lobes end acutely, the serrations of the lobes are acute and the indentation between the central and lateral lobes is deep. The base of the leaf, on the contrary, is fairly level.

Blossom and Fruit.—One to three racemes (blossom chains) spring from a fruiting spur, each bearing from six to ten individual flowers, so that the raceme is of but medium length. The stigma (the female part of the flower) is frequently above the anthers (the male part carrying the pollen). Not all the flowers set fruit, so the trusses are short, and fruit medium sized; ripens in mid-season, very acid. The berries have a tough skin and travel well.

This variety under most conditions appears resistant to big bud, but often shows reversion.

Merveille de la Gironde, North Holland Black, Resister, Ogden's Blue, Lee's Prolific, Black Naples, Seabrook Black, Mammoth, and Westwick are varieties belonging to this group.

GROUP II.—BOSKOOP GIANT TYPE.—Bush and Leaves.—A sturdy, spreading and rather scantily branched bush of medium size. The buds are large, broad and blunt, pink to purple in colour. These buds give rise, early in the season, to large flat leaves less angular than French, and held at right angles from the stalk. The lobes are broader, and end less acutely; the serrations generally are crenate. The base of the leaf is deep, indented by the leaf stalk.

Blossom and Fruit.—The fruit spur, late in the season, frequently develops but one raceme (blossom chain), but this a long one containing from twelve to nineteen large flowers, with the stigma projecting above the anthers. The trusses of fruit are long, though many of the bottom trusses fail to set their fruit, and running-off is considerable. This type is the earliest to ripen its berries, which are moderately sweet, and provided with tender skins. To carry well, marketing should be done before the fruit is ripe. Other varieties of this group are Hoogendyk's Seedling, Prince of Wales, and Black Bunch.

GROUP III.—VICTORIA TYPE.—Bush and Leaves.—The bushes are of medium size, very erect, and the branches a very light buff colour and often forked. The buds are small, somewhat crowded, conical in shape and pointed, and of a very light green (almost white) colour; the scales are loosely arranged around the buds. The variety comes early into leaf, and the leaves are small. The lobes are irregular in shape; the terminal tending to be tri-lobed; the laterals are irregular in outline; the indendation at the meeting of the lobes is often very deep; but the base of the leaf is fairly level, or with but a shallow indendation by the stem.

Blossom and Fruit.—Usually three to six racemes (blossom chains) develop from each fruiting spur; each raceme has from eight to eleven single small flowers. In this variety many of the stigmas (female portion) are slightly above the anthers. There is some running-off in this variety, but it is not extensive. The trusses are short and crowded together; the berries ripen in mid-season, they are large, sweet, and have moderately thin skins.

Goliath, Edina, Monarch and Bang Up are well-known varieties of this group.

GROUP IV.—BALDWIN TYPE.—Bush and Leaves.—The least vigorous of all the cultivated black currants, making a dwarf though compact bush. The light green coloured buds are large and long, conical in shape, and pointed. The scales are very loose and ragged. The variety is the earliest to develop leaves; these are small and very regular. The central lobe is somewhat long, and ends acutely, which tends to give the leaf a long appearance. The indentation at the base of the leaf is very deep.

Blossoms and Fruit.—From each fruiting spur two or three racemes (blossom chains) usually develop each containing from six to twelve individual flowers, in which the stigmas (female part) are generally on a level with the anthers (male part); this apparently facilitates pollination, for little "running off" occurs and the fruit sets well. The berries are of medium size, ripening late in the season, somewhat acid, and with tough skins which allow the fruit to be marketed even when fully ripe.

Emsden Defiance and Bodenburg's Black Prince are varieties of this group.

RED CURRANTS.—The demand for this fruit is more limited, and the market is at times over-supplied. The crops are easily grown, and, where good cultivation is adopted, heavy and regular crops can be secured. The bushes are propagated from cuttings taken and planted in a similar manner to that described for black currants, though all except the three or four buds at the top of the cutting should be removed; the bushes then will remain free from suckers.

Red currants flourish best in the lighter soils, and can be grown successfully under top fruit.

Planting and Manuring.—The bushes should be set less deep than is recommended for black currants, and the distance for planting is 5 ft. square.

The bushes require less organic manure than black currants. In addition this crop is favourably influenced by artificial fertilisers, such as potash salts given in conjunction with phosphates and nitrate of soda.

Pruning.—The red currant bush should be cut in quite a different manner to that described for black currants. The red currant bears chiefly on the fruiting spurs formed on the older wood. The aim should be to produce a bush of six or seven principal branches evenly arranged so as to form an open basin to facilitate the ripening of the fruit. Two or three hard prunings should be sufficient to obtain this. Subsequent prunings merely amount to cutting the main branches back to an outside bud to leave about 6 in. of the currant growth each year. All laterals should be cut back close to the fruit buds at the base. The summer pruning of all laterals to about 4 in. before the fruit is picked usually proves advantageous.

Varieties.—In the breeding of the cultivated red currant three distinct species have been used (*Ribes rubrum*, *R. vulgare*, *R. petraeum*), and as would be expected the characters of each of these species appear in varying degrees in most of the present varieties. Thus it is convenient to classify the varieties into groups according as their botanical characters show a strong resemblance to these three species.

Certain well known varieties are selected as types.

I. *The Rubrum Group.*—Varieties placed in this group have pitcher-shaped flowers, held stiffly out on wiry stems. Varieties of the Raby Castle type also have downy leaves—which is not so with the Scotch type.

(a) RABY CASTLE TYPE.—*Raby Castle.*—Bush and Leaves.—A medium sized bush, upright, with broad light yellowish-green leaves, very hairy on the underside.

Blossom and Fruit.—The blossom-truss, which appears before the leaves, is of medium length, bearing a number of pitcher-shaped, green flowers, without fleshy ring round pistil. The fruit is carried on stems (pedicels). The berries are of medium size and of a bright red colour, which is maintained on ripening. A fertile late-season variety.

Houghton Castle (synonym New Red Dutch).—This variety is often mistaken for Raby Castle, from which it differs by having silvery foliage. The bunches are longer, the fruit stems long, and on ripening the berries turn darker to a dull, red colour

(b) THE SCOTCH TYPE.—*Scotch* (synonyms London Market, Fowler's London Red).—Bush and Leaves.—A large Bush with upright sturdy branches, bearing large buds (winter stage), and in the summer stage light green small leaves, held horizontally to the stem by stiff wiry stems. Stiffness is the characteristic of this variety.

Blossom and Fruit.—Bell-shaped light green flowers held outwards on a short wiry stem which is somewhat hairy. The berries are close together on one side of the bunch, which is of medium length, held on a stiff wiry stem (rachis). A prolific early cropping variety of bright red berries suitable for market purposes.

II. *The Vulgare Group.*—This section contains those varieties with characteristics indicating their descent from *R. vulgare.* The flowers are very open, almost flat, and show a distinct fleshy ring round the pistil. The stems of the flower and fruit racemes are long and thin, so that the trusses hang downwards, with the fruit lying on all sides. The foliage is large and pointed, but thin. The berries are big. Varieties in this group commonly have buds which go blind, and brittle shoots which often snap off when bearing heavy crops, or when exposed to high winds.

(a) VERSAILLES TYPE.—*Fay's Prolific* (synonym Comet).—Bush and Leaves.—A medium bush, fairly upright, with long pointed buds, and large dark green leaves, not hairy. The tips point downwards. An early variety.

Versailles (synonyms Eclipse, Magnum Bonum).

(b) THE DUTCH TYPE.—*Perfection* (Laxton).—Bush and Leaves.—A small bush composed of short branches, with small buds and dark green leaves. A late variety.

III. *Goudouin Group*—In this group are placed those varieties which exhibit characters indicating their descent from *R. petraeum.* Stout, flat, very large leaves; red shoots; claret-red coloured flowers, raceme long, held stiff, flowers open and bell-shaped, with the outer edges turning outwards rather like the flower of a Campanula. Late at starting growth in the spring, and hesitating in shedding its leaves before the winter months. Goudouin, Prince Albert and Seedless Red are varieties of this type.

IV. *Varieties Outside the Groups.*—There are some varieties with mixed characters so that they do not well come into any particular group.

Victoria (synonym Wilson's Long Bunch).—Bush and Leaves.—The growth is very straggling and uneven; the buds slender and long; the leaves brownish, with leaf stems (petioles) long, middle leaf lobe very pointed.

Blossom and Fruit.—The flowers are of the open, flat type, similar to *R. vulgare*, with a fleshy ring around the pistil. The sepals are separated and well apart. The stem (rachis) of the fruit truss is very long and moderately stiff, and the berries separated so that the bunches appear very long. Very late variety.

Marketing.—Good samples of early varieties of red currants are packed in 1 lb. punnets and sold to be mixed with raspberries for dessert. Black and red currants are also marketed in chip baskets containing 4 lb. and 6 lb. respectively. The bulk of the crop of both red and black are marketed when the berries are quite firm in strikes of 12 lb. and in bonnets and half sieves containing 24 lb. These packages, which should be lined with clean tissue paper, should contain only sound fruit packed and no leaves. When full the paper should be folded over the top so as to make a neat appearance.

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THE HEDGEHOG.

H. MORTIMER BATTEN, F.Z.S.

To endeavour to lay down hard and fast rules as concerns the habits of any bird or animal is invariably to invite criticism, for not only do their immediate surroundings influence their ways, but in the world of fur and feather there is just as much individuality as in the world of men. Thus has the wolf cattle-killer been known to acquire a taste for strawberries, thus has the rabbit become wedded to the art of snail-catching, and thus too we have the squirrel which kills song birds. Only one thing is invariable in wild nature, and that is its variability.

This rule, if an order which dispenses with all rules may be termed a rule, applies to the hedgehog as strongly as it does to any beast. Few creatures vary more in their habits than does the urchin of the undergrowth, regarding whom every agriculturist should have some knowledge, for it may be said that the hedgehog is everywhere beneficial to the agriculturist. Game preservation, on the other hand, stands to lose a little if this beast be too abundant, but these points will become evident as we proceed with its history.

A few notes from my own studies will serve to illustrate the variability, or rather the adaptability, of the hedgehog. Some years ago I spent a few months on an estate in Dorsetshire where hedgehogs were abundant. In that locality the undergrowth was dense and prolific, and the hedgerows grew rank, with the result that the hedgehogs were surrounded by an abundance of their natural insect fare. So the gamekeepers had no quarrel with them, and I have seen a whole family of hedgehogs meandering about the keeper's garden paths at sundown. The man informed me that he had never found them guilty of egg stealing, the crime for which the animal is chiefly condemned, while he recognised the fact that such assiduous insect hunters were beneficial to his borders. Incidentally I might mention that a pied wagtail brought off her brood in a rockery about which the urchins were regularly to be seen.

My next study of the species takes us to a bleak and rocky limestone valley in the north of England. There was very little heavy timber in this valley, though the abundance of hazel bush and silver birch along the stream edge had long afforded shelter for several prosperous families of urchins.

Here, naturally, there was little insect fare, with the result that the hedgehogs had to look in other quarters for a living, and it soon became evident that they depended mainly upon the rabbits. The rabbit catcher told me that they were the worst snare robbers with which he had to contend, and if, when ferreting, we were compelled to dig, we almost as often as not unearthed a hedgehog from the burrow. Evidently they claimed free usage of the warrens, retiring there to sleep away the daylight hours.

So far as the free and adult rabbits are concerned the hedgehog is, of course, helpless, but in this locality the animals had acquired the habit of hunting out the nesting " stops," in which the newly-born rabbits lay at the end of the narrow shaft. Often these breeding burrows are so small that one would think a hedgehog could hardly squeeze into them, but he appears to have no difficulty in that way, and once he is inside the young rabbits are doomed. The hedgehog may remain in the same stop two or three days till the meal is consumed, when he moves out in search of the next. Regularly we found the animals walking about with their coats thickly matted with rabbit nesting materials, which was certainly strong enough evidence as to their habits. In many parts of the Highlands I have found the hedgehogs addicted in just the same way to rabbit hunting, which, so far as agriculture is concerned, is perhaps another point in their favour.

This beast, like every other, follows the lines of least resistance. Where insects are abundant and he need move only a few yards to fill himself on such fare, he does not acquire habits of a destructive kind. Occasional old hedgehogs may stray from the prescribed pathways of virtue, thus bringing destruction upon their race, but if the individual be trapped and killed the mischief will probably cease. If, on the other hand, insects are scarce, the hedgehogs turn to the next most fruitful source of supply. Possibly the abundance of rabbits offers an easy solution, or possibly an abundance of ground-breeding birds results in the hedgehogs of the locality becoming habitual egg and chick thieves.

I have never visited the rabbit-infested areas of Australia, but I should imagine that the hedgehog would find insect fare none too abundant where the rabbits abound, and I would suggest that a few consignments of hedgehogs might assist the balance of nature as regards a reduction of the wild rabbit's numbers. Where, in the interests of game preservation, such beasts as the hedgehog and the stoat, and such birds as the buzzard have been practically wiped out, farmers are up against the same problem in this country, though of course on a smaller scale, as are their brothers in Australia, where the rabbit was imported without his natural foes.

Kept in an enclosed garden hedgehogs make interesting pets, and very amply pay their way by the number of noxious insects they kill. They quickly become quite tame, allowing themselves to be touched and stroked without erecting their quills, and within two days of its capture a hedgehog will take food—such as a scrap of bacon rind—from the fingers of its captor.

Though the hedgehog cannot be set down as of much value in the destruction of rats, the animal nevertheless takes rank among the natural foes of the rat and his race. I recollect one evening being roused from my work by the sound of a dead thud on the gravel path outside my window, followed by much squealing, and going out I found a hedgehog and a rat engaged in deadly combat. They must have fallen interlocked from the dense creeper above the window, but unfortunately both of them heard my steps and made off, so that I was deprived of witnessing the conclusion of the fight. On another occasion a noise of squealing at the back of some farm buildings took me to the scene, and there I found several rats in the act of mobbing a hedgehog.

It may strike some people as strange that so inactive a beast as the urchin should essay to climb into a creeper, but we need to remember that the hedgehog of the daylight hours is a very different beast from the hedgehog of the night. In the dusk of evening I have seen one of these animals pick himself up and spring off almost as nimbly as a rabbit, and certainly they can climb well. One which was kept in a garden used regularly to climb into the fruit trees and creepers which covered the boundary wall, and it was on a platform of leaves in the creeper, nine feet or so from the ground, that this animal made its winter nest.

Hibernation.—The hedgehog hibernates in the true sense. During the autumn months he lays on fat, and when the leaves begin to drift he acquires, accidentally or otherwise, an overcoat of leaves. These become impaled upon his quills, the second layer ramming the first layer home, and so he goes his way impervious to wind and rain. As the weather turns colder he becomes more and more sluggish, and, no longer a vagrant, he spends much of his time sleeping in some cosy nook abundantly lined with leaves.

I have examined the hibernating quarters of several hedgehogs, and they vary considerably. One I found denned up in a shallow rabbit burrow. The animal was rolled up and thickly entangled in a bed of dry grass, much like a chrysalis in its cocoon, but in addition the animal had dragged quite a sackful of leaves into the burrow. It was, indeed, full of leaves, and the burrow mouth was entirely buried under the leaves which had drifted over it, so that not only was the little stronghold entirely hidden from view, but the sleeper within was certainly secure from rain and frost.

On another occasion I found a great bundle of hay in the corner of a ruined building, and investigation showed it to contain a hibernating hedgehog. Yet another of these beasts decided to hibernate among some sacks in a corner of my motor house, but had to be ejected on account of its primitive sanitary arrangements. In my boyhood one of them several times did his best to settle for the winter under a gardener's coat, which the man was in the habit of throwing down in a corner of the potting shed.

Providing the animal dens up in good health and his den is weather-proof, he will sleep without rousing from early November till the month of March.

Breeding Habits.—As is the case with the badger, mating begins immediately succeeding hibernation. According to such evidence as at present exists on the subject, the period of gestation occupies seven weeks, and since the first young are born in March—that is in the south of England—the first hedgehogs must be astir early in February. So far as I know, the sexes never den up together, and I personally have never seen hedgehogs astir before March. In Scotland the young very seldom appear earlier than mid-April. Generally there are two litters during the season—the second arriving as late as August. The latest nest I ever heard of contained newly born young in the middle of September, but this was in Highland country.

The young are born blind, and the quills are present at birth, but they are flexible and white. They first leave the nest with their mother at the age of about eight days, but generally keep to the densest thickets, so that they are very seldom found at this early age. They remain with their mother until full grown, which accounts for the frequent discovery of a number of hedgehogs together at night-time during the summer months.

Though normally silent animals, hedgehogs possess considerable vocal powers. When trapped they utter a squalling scream which can best be described as midway between the squealing of a rabbit and the sounds of a cat-fight. The young utter various bird-like notes to attract their parents, among these notes being a distinct whistle not unlike that of the blackbird.

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DATES OF BLOSSOMING OF PLUMS.

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CULTIVATORS of plums from early days appear to have had varied experiences in obtaining satisfactory crops with all kinds of plums; and some varieties were soon termed " bad croppers." Whilst in most cases plums of the gage type, such as Coe's Golden Drop and Late Orleans, appeared in this category, there were other varieties which cropped well in some orchards but proved failures in others, just as Rivers' Early is doing at the present time. The reasons for these varying crops have never been completely understood, but step by step scientific workers are throwing light on these obscure problems.

Assuming that the soil and the tree growth are satisfactory for crop production, it is, in the main, still necessary for the female portion of the blossom (the stigma) to receive the pollen from the male portion before fertilisation can proceed, and the production of a real fruit can commence. Now the blossom of the plum contains both the stigma and the anthers carrying the pollen grains, but for some reason, still obscure, it is the exception rather than the rule for the pollen grains to be active on the stigma of the same variety. In other words, many varieties of plums are self-sterile, and the stigma of one variety needs to be supplied with pollen from another. Pershore Yellow and Purple egg plums, Monarch, Victoria, and Czar, are exceptions, for they possess considerable powers of self-fertility and are able to produce satisfactory crops without the aid of other kinds.

Whilst this has been suspected for many years, its truth has only been confirmed by the work of recent research workers, and it emphasises the need for full details regarding the behaviour of the blossoms of the varieties usually planted in commercial orchards. Even this would scarcely suffice because a variety of plum remains in blossom, and especially full blossom, for but a few days; nor do all kinds commence to flower at the same time. Mr. Udale, from 21 years' recording work at the Worcestershire County Council Garden at Droitwich with 36 varieties of plum, found the average difference in the time of blossoming of plums, between the earliest varieties to flower and the latest, to be about 18 days. The intervals naturally vary with the prevailing weather, and were as short as 8 days in 1917, and as long as 39 days in 1918. Mr. Cecil Hooper, of Wye College, and others have made observations with similar results.

It is evident that much can be done towards ensuring better crops of fruit by arranging trees of these stone fruits in the orchard in such a way that with the self-sterile varieties there are interplanted some varieties to facilitate pollination. The important point seems to be that the two varieties must have flowering periods which are similar or which overlap to some extent. Thus, Belle de Louvain would appear to be a suitable pollenizer for Pond's Seedling and *vice versa*, but in normal years neither might be of use for, say, Rivers' Early Prolific, for which Pershore Yellow Egg, Czar, or Prince of Wales would be preferred. More records and research are needed before advice in all cases as to the best pollenizers can be given, but fruit growers are indebted to Mr. Udale, Mr. Hooper, and Mr. Crane of John Innes Institute, Merton, and others, for the investigations which they have made into the sterility and fertility of varieties and their order of flowering.

From their records it would appear that plums should be grouped as follows, for flowering and fertility* :—

Early Flowering Varieties.

Black Diamond (S), Prince of Wales (F_1), Curlew (S), Monarch (F_1), Jefferson's Gage (S), Coe's Golden Drop (S), Denniston's Superb (F), President (F_2), Old Greengage (S).

Mid-season Flowering.

Rivers' Early Prolific (F_2), Bryanstone Gage (S), Wyedale (S), Victoria (F), Early Orleans (F_2), Farleigh Damson (F_2), Pershore Yellow Egg (F), Pershore Purple (F), Kirker Blues (S), Magnum Bonum (F).

Late Flowering.

Czar (F), Washington Gage (S).

Latest.

Pond's Seedling (S), Gisborne's Early (F), Kentish Bush (F_2), Belle de Louvain (F_2).

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* (S) means self-sterile.
(F) signifies that the variety is strongly self-fertile.
(F_1) occasionally self-fertile, and (F_2) rarely self-fertile.

The result of the cropping of 38 varieties of plums during 21 years at the Droitwich Gardens, recorded by Mr. Udale, gave the following average crop per tree:—Pershore Yellow Egg (70 lb.). Smith's Purple Prolific (55 lb.), Victoria (54½ lb.), Rivers' Early Prolific (44 lb.). Prince of Wales (34 lb.), Monarch (34 lb.), Czar (32 lb.), Jefferson (29 lb.), Belle de Louvain (28 lb.)). Pond's Seedling (14 lb.), Czar (11 lb.), and Coe's Golden Drop (7 lb.). The average yield during 21 years of 54 trees of 37 different varieties was 40½ lb. per tree per year.

The trees on which the records were made were planted in 1896, and in the following table there is set out the behaviour as regards blossoming and cropping during the periods of time each of seven years duration.

Whilst there is no definite correlation between the yield and the period of flowering, it does seem to be the case that early blossoming in March is not conducive to high yield, probably because of frost risk.

Year.	*Earliest and latest to blossom of 38 varieties of plum.*	*No. of days difference.*	*Yield per annum of 54 trees.*	
1900	April 19—April 28	9	228¾	*First 7 years:*
1901	April 16 April 27	11	2.110½	Total yield
1902	April 5 April 24	19	557	7,020¼ lb.
1903	March 4—April 7	34	93	Average yield
1904	April 11—April 24	13	1,303	per tree per
1905	March 29—April 18	20	2.713½	annum—
1906	March 28 April 15	18	14½	18½ lb.
1907	April 1—April 21	20	4,359½	*Second 7 years:*
1908	April 13—May 2	19	4,550	Total yield
1909	April 12—April 27	15	2,966½	19,875 lb
1910	April 5—April 22	17	2.736½	Average yield
1911	April 5—April 22	17	1,603½	per tree per
1912	March 17 April 6	20	2.076	annum—
1913	March 9—April 17	39	1,583	53 lb.
1914	March 29—April 15	17	3,600	*Third 7 years:*
1915	April 7- April 26	17	1.154¾	Total yield
1916	March 29 - April 22	24	2.081¾	18,203½ lb.
1917	April 30—May 8	8	7,332	Average yield
1918	March 20—April 4	15	303	per tree per
1919	April 18—May 4	16	2,048	annum—
1920	March 4—March 28	24	1,684	48 lb.
	Total yield in 21 years		45,098¾ lb.	

Average difference between first and last varieties to commence to flower 18⅔ days.

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PEPPERMINT: ITS CULTIVATION AND DISTILLATION.

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THE Oil of Peppermint of commerce is an extremely pungent volatile oil obtained by distillation of the stems and leaves of species of *Mentha*, a genus of the family *Labiatæ*. This oil is the source of the well-known peppermint flavour and aroma, possesses marked medicinal properties, and finds a ready market amongst the confectionery, pharmaceutical and perfumery trades. The oil is also used in the production of creme-de-menthe and other liqueurs.

Peppermint has been cultivated for centuries in the Mitcham district of Surrey, where the acreage once totalled 300 acres, but at the present time is probably not more than 150 acres. Market Deeping in Lincolnshire and Hitchin in Hertfordshire have also been large centres for this industry.

The species grown is *Mentha piperita*, and two varieties are recognised by growers, one being known as black mint (*Mentha piperita nigra*) and the other as white mint (*Mentha piperita alba*). The former is recognised by its purplish stems and dark olive green foliage, while the latter has green stems and lighter foliage, and is generally of less vigorous growth. Also, the leaves of the black mint are much more finely serrated. Although the oil derived from white mint is of a finer quality and commands a higher price than that from black mint, the latter yields more, and is the variety generally grown in this country.

Cultivation: Suitable Soils and Situations.—Although an indigenous plant, and therefore more at home in this country than lavender, peppermint has been found to succeed commercially under somewhat similar conditions to those required by that crop, and is therefore generally grown in association with it. It does well in light calcareous soils and is therefore a very suitable crop for the chalk lands, providing, of course, there is a sufficient depth of soil above the chalk. Friable sandy loams or gravels will grow the crop also, in fact any soil is suitable when well drained, except heavy clay.

It has been found, however, that both the quantity and the quality of the oil is influenced by soil and situation. The crop pays best in open sunny situations where the rainfall is not normally excessive during the growing months—April to August

—moist heavy weather affecting the oil production considerably. Being herbaceous it is unaffected by winter conditions, and may therefore be grown where lavender would be killed by the frost.

Preparation and Planting.—Having selected the site, care must be taken to ensure its thorough cultivation, bearing in mind that the crop can profitably occupy the land for four or five years if well prepared beforehand.

Unless the land has previously carried a crop which demanded good cultivation, such as potatoes, it should be ploughed and cross ploughed, and if a hard pan is present that must be broken with a sub-soiler.

A good dressing of farmyard manure—from 15 to 20 tons per acre—should be ploughed in, and it will pay to see that the land is thoroughly cleaned and brought into a good state of fertility. The preparation of the land will be done during the autumn and winter, and at the final ploughing it should be laid up in lands about 5 ft. or 6 ft wide, with furrows about 18 inches wide between. The usual practice is to have the beds about the width of the cart wheels so that the latter run in the furrows, with the least damage to the mint. This bed system of cultivation is the best, as it must be remembered that weeding and harvesting is all done by hand, and pathways at suitable distances apart greatly facilitate operations. Land so prepared will have a good tilth by the spring, when the beds are levelled down with hand rakes and are ready for planting.

In commencing the cultivation of this crop for the first time it will of course be necessary to buy in a stock of mint. Every care must be taken to ensure that the true plant is obtained. It should be purchased if possible from an actual grower, in a recognised peppermint district, otherwise it is a risky matter. This question of stock is a very important one.

Peppermint is propagated by means of young plants which arise in spring from the "runners" or creeping root stocks which are produced in quantity on established beds. A freer production of young plants is often induced by covering the beds with friable soil from the furrows. Planting is done as early as plants become available, usually during March and April. The plants are dibbled in about 12 in. apart to ensure an even spread. It is estimated that about 42,000 plants are required to plant an acre.

In newly planted ground peppermint requires a good deal of hand weeding in order to keep the land free from weeds until the mint is established. A hoe cannot be used without injury

FIG. 1. Harvesting Peppermint.

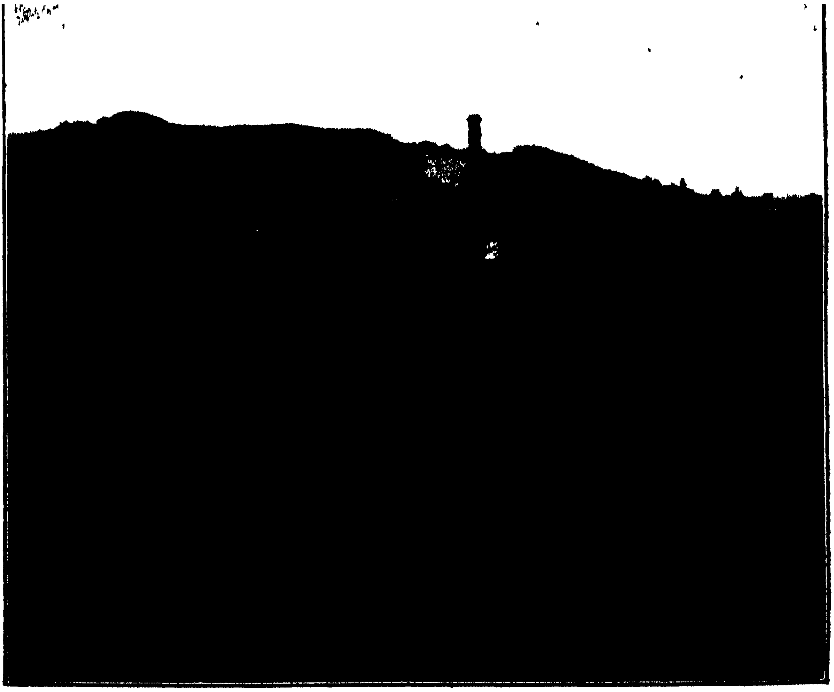


FIG. 2.—Peppermint Field at maturity. A Distillery in the background.

to the growing plants. The furrows between the beds must also be kept free from mint, so as to keep a free passage.

After the beds are cleared in the autumn they should receive a dressing of dung, and the beds are ploughed over to divide the runners and cover them with soil. Fish guano and Peruvian guano applied in the spring have been found to give good all-round results in the past, but many growers now apply a dressing made up of sulphate of ammonia, superphosphate and sulphate of potash according to the nature of the land. It certainly pays to apply this annual dressing after the first year and while the crop occupies the land. The potash is especially valuable as it has been found to help the plants resist the rust disease referred to below. A useful dressing would be 1 cwt. of sulphate of ammonia, 2 cwt of superphosphate, and 1½ cwt. of sulphate of potash to the acre.

Harvesting the Crop.—The crop is ready for harvesting about the second week in August, just before the flowers begin to open. The stills are then got to work and distilling goes on night and day without a break until the crop is finished. Crop time may last 3 or 4 weeks according to the area under cultivation and the rate at which the distilling can be undertaken. As mentioned above, the whole of the plant above ground contains oil and is harvested.

Cutting is done with small sickles known as mint hooks, and should only proceed in fine weather. As the mint is cut it is laid on the beds in long even rows to dry. After lying for a day or two in fair weather it is gathered in small heaps and left again for two days, being turned once in the meantime. Given good weather, the mint should then be in a fair condition for "stilling," and is then made up into large bundles of about 1 cwt., enveloped in mats, and is carted away to the distillery. In this condition the mint will keep indefinitely, and harvesting is then independent of the capacity of the still to deal with it.

In cutting the mint it is important to see that no noxious weeds are reaped with it and conveyed to the still. Such weeds as ground ivy (*Nepeta Glechoma*), cat mint (*Nepeta cataria*), and goose foot (*Chenopodium* spp.), are particularly troublesome, and must be guarded against, otherwise the flavour and colour of the oil may be injured.

Distilling.—The cost of putting down a distilling plant is a considerable item. For this reason, in a peppermint-growing district, the smaller growers generally take their crop to the distillery of larger growers, where it is distilled for an agreed sum. This is a convenient arrangement and accessibility to a local still is one of the main considerations when commencing to grow this crop on a small scale. On the other hand there are several manufacturing firms who are now making small efficient stills suitable for small growers, and whose advice should be sought.

On account of the bulky nature of the crop the stills must necessarily be of large dimensions. They are best constructed of copper throughout, and are generally built to take charges of from 15 cwt. to 1 ton at a time.

The capacity of the copper depends largely on the state of the crop when it is brought to the still.

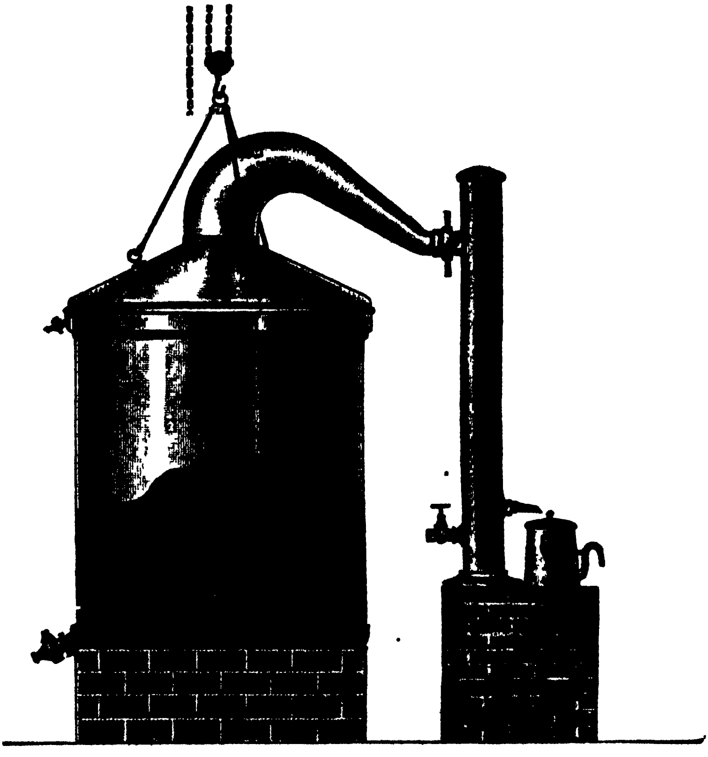
A type of still in use amongst several growers is illustrated in the accompanying photograph. The stills are constructed with a false perforated bottom. Water is poured into the empty still until it rises about 2 ft. into the charge chamber. The mint is then packed in and firmly trodden down until the load is level with the top of the still. The still head is then let down by pulleys and clamped down into a waterseal joint.

The distillation is conducted by boiling the water beneath the charge chamber by means of steam conveyed from a boiler at pressure to a coil, the top of which should be well beneath the false bottom. The application of direct heat to the stills is now obsolete on account of the risk of burning, etc.

The distillate will commence to pass over in about half an hour, and complete distillation of the charge usually takes about six hours, by which time all the oil will have passed over. The oil is completely insoluble in water. and readily separates out in the separator as it comes from the condenser. After each charge the oil is " taken off " by first pouring off the " mother liquor," which is saved and put back into the next charge along with the overflow in the tanks. the oil being then poured into Winchesters and weighed, so that a check can be kept upon the yields.

After each distillation the charges are drawn by special gear, the spent mint being carted back to the fields by the returning carts, and rotted down for manure. This spent mint forms good organic manure. and should be mixed with the farmyard dung which is applied to the land in the autumn as above stated.

Yield.—It is difficult to give any definite figures as to yield. As stated above the oil production is extremely variable, being influenced considerably by the season, soil, and situation, as also is its quality in respect of flavour and odour. When grown under conditions which tend to assist oil production, and given a fair season which has been warm and dry, a yield of oil at the rate of from 10-12 lb. to the ton of partly dried mint would be a good return. An average crop of green mint grown under favourable conditions on established beds would be between 3 and 4 tons per acre. A good average yield for well-cultivated commercial crops would therefore lie between 30 and 40 lb. of oil to the acre. Under adverse conditions only half these figures might apply, whereas record yields have been obtained under extremely favourable conditions as high as 100 lb. to the acre.



A modern Peppermint Still, showing new pattern Condenser.

The oil is usually disposed of straight away to the merchants, by whom it is mellowed in storage before being sold to the consumer. The product is extremely sensitive to light and temperature, and must be stored in complete darkness, preferably below ground in concrete chambers.

Diseases.—Peppermint is often badly attacked by Mint Rust, sometimes referred to as " Snuff disease " by growers, caused by *Puccinia menthæ*. This disease has been known to destroy whole beds of mint, and must be constantly watched for, and precautions taken against its spread should it appear. It is easily distinguishable, as all stages appear on the one host, the bright orange cluster cup phase of the fungus, which appears in the early summer on the stem, being especially noticeable. This disease is most troublesome during wet seasons, and it should be borne in mind that all species of wild mints are often badly attacked, and may provide a source of infection if left undestroyed.

The only remedy, once the disease has appeared, is to remove the affected plants entirely and burn them. Affected plants can be distinguished very early in the season, before spores are produced, by their pale leaves and distorted, stunted stems. The mycelium of the fungus winters over in the underground portion of the plant, therefore plants once attacked are likely to remain attacked unless destroyed.

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NOTES ON MANURES FOR NOVEMBER.

SIR JOHN RUSSELL, D.Sc., F.R.S.,
Rothamsted Experimental Station, Harpenden

The Cropping Policy.—One of the most serious questions now engaging the farmer's attention is the cropping policy that should be followed on the farm. It is an extraordinarily difficult question, and one that in the end each man must decide for himself after full consideration of all the circumstances of his own case. The fundamental idea underlying these notes, and indeed all of the writer's work, is that whether a man lays down more grass or whether he keeps up his arable area, he must produce good crops or he cannot meet his standing charges. Unmanured arable crops give less profitable returns in good times, and in bad times they involve a greater loss of money, than crops which are properly manured. Much of the grass land of the country, both hay and grazing, can be considerably improved and made more profitable by suitable manuring. There is, of course, such a thing as over manuring, but in ordinary farm practice this is very rare; it is much more common to see unsuitable and therefore wasteful manuring. In the writer's experience, however, a crop which is unprofitable when properly manured, does not become profitable by giving less manure. In his view the proper way to meet low prices is to go carefully over every item of expenditure and every process in the production of the crop to discover whether it is possible to bring down the cost of production per ton or per bushel of produce; to see also if it is possible, by using improved varieties, by better schemes of manuring, or by better soil management to obtain larger yields at the same or only slightly greater expenditure of money. If when all this is done, it still appears that the farmer's best efforts will involve him in a loss, then let him put his land into some other crop.

Can Kainit be applied late to Wheat?—On chalk soils kainit is well known to have a beneficial effect on wheat, and a correspondent asks whether it is safe to apply this substance after the wheat is up. There is probably little risk of injury in the autumn or early winter, but it is unwise to use kainit in this way on arable crops; its proper use is to go in with the seed or earlier.

Kainit, as is well known, is the least concentrated of the potassic fertilisers; it contains salt, and in the case of German kainit, a magnesium compound as well. The salt and probably the magnesia have value on light soils and on mangolds, though they are not as useful as potash itself. The so-called "extra kainit" and the potash manure salts are both more concentrated, supplying a larger amount of potash per ton; they may prove more economical where cartage or freight charges are heavy.

Manuring of Leys: Use of Longer Leys.—Special attention should be given to the leys, as where a mixture has been sown in place of pure clover it may be found desirable to keep the ley down for another year. A dressing of basic slag or finely-ground mineral phosphate (120-mesh sieve) is useful in early winter if the clovers are well established, but where the clover has failed in many places it is probably better to wait till spring and then apply a nitrogenous manure to bring on the grasses. The best time for manuring of leys, however, is when the nurse crop is being sown; the slag or mineral phosphate put on then helps the young clovers considerably. It may happen, however, as at Rothamsted this year, that potassic fertiliser is also necessary. Clovers sown in a nurse crop of barley which had received potash as well as phosphates made much better growth and gave a heavier yield than when the barley had received phosphates only. It is only when the manuring of the nurse crop has been omitted that it becomes necessary to put manure on to the stubbles of the nurse crop.

A London Ash-pit Refuse.—The Council of one of the large London boroughs has been pulverising refuse after the removal of rags and bones and has obtained a product in a fairly fine state of division :—

Moisture	18·20
* Organic Matter	20·08
Oxide of Iron and Alumina	8·68
† Phosphoric Acid	0·37
Lime	3·40
Potash	0·32
Magnesia, Alkalies, etc.	6·34
Insoluble Siliceous matter	42·61
	100 00

* Containing Nitrogen	0·36
Equal to Ammonia	0·44
† Equal to Tribasic Phosphate of Lime	0·81

This material is poor in organic matter, the chief fertilising constituent of town refuse, though it would have a good effect in lightening heavy soils. It would probably be useful to heavy land farmers if it could be obtained on the field at 3s. to 4s. per ton, though it would hardly be worth more.

If the rags and bones were left in a richer material would be obtained, but probably it is more economical to separate these substances and sell them separately.

Some Cheap Lime.—One of the large chemical manufacturers of the north is putting on the market a waste lime which has been dried and pulverised, containing about 80 per cent. carbonate of lime, or 44.8 per cent. of calcium oxide, the remainder being water, at a price of 5s. per ton. This is very cheap and should allow of the application of lime to soils badly needing it but in regard to which the cost of the dressing has hitherto been prohibitive.

* * * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending October 10th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.12	13.15	13.10	13. 2	16.11
„ „ Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13. 9*	13. 9*	13. 9*	13. 9*	(N)13. 0
„ „ „ neutral (A. 25¾ per cent.)	14.12*	14.12*	14.12*	14.12*	(N)13.10
Kainit (Pot. 12½ per cent.)	...	..	...	1.17	3. 0
„ (Pot. 14 per cent.)	2. 2	...	2.10	2. 5	3. 3
Sylvinite (Pot. 20 per cent.)	...	...	...	2.10	2. 6
Potash Salts (Pot. 30 per cent.)	...	..	...	3.10	2. 4
Muriate of Potash (Pot. 50 per cent.)	8. 5	7. 0	8. 0	7. 0	2.10
Sulphate of Potash (Pot. 48 per cent.)	...	...	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.)	...	...	...	3.10§	2. 0
„ „ (T.P. 30 per cent.)	...	...	...	2.17§	1.11
„ „ (T.P. 26 per cent.)	2.13§	2. 8§	...	...	..
„ „ (T.P. 24 per cent.)	2. 9§	2. 4§	2. 2§	...	...
„ „ (T.P. 20-22 per cent.)	...	2. 1§	.	2. 5§	2. 3
„ „ (T.P. 18 per cent.)	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.)	3.17	...	3. 7§	3. 7	1.11
„ (S.P. 30 per cent.)	3.10	...	3. 0§	3. 0	2. 0
Bone Meal (T.P. 45 per cent.)	9.10	...	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.)	...	6.10†	6.15	6. 2	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)	12.15	...	12.10	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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MONTHLY NOTES ON FEEDING STUFFS.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Animal Nutrition Institute, Cambridge University.

The Use of Home-Grown Foods for Stock.—Notes have appeared in this column and elsewhere from time to time on the value and use of home-grown feeding stuffs. From the opinions that the writer has obtained from practical farmers it seems clear that there is no agreement among them on the value and use of home-grown cereals. Barley may be taken as a case in point. In the Eastern Counties generally barley is looked upon with disfavour for use with any stock other than fattening pigs. If used to any extent with breeding sows or with dairy cows it is said to dry up the milk.

On the other hand, it is a common practice in the North of England to feed barley to milch cows in conjunction with other foods. A farmer recently informed the writer that he placed great reliance on soaked barley as a milk producer, used in suitable conjunction with other foods.

In view of this lack of agreement, any positive evidence on the practical side of the value of suitable mixtures of home-grown feeding stuffs for stock is worth recording, and the writer, through the kindness of a correspondent, is enabled to record one experience on the value of home-grown foods. This correspondent has been accustomed for some time past to feed his own corn to stock with favourable results. Last year he ground up over 2,000 bushels of wheat, barley, oats and beans. The following are the mixtures he likes best for the different classes of stock:—For pigs, a mixture of 1 cwt. of wheat, 1 cwt. of beans and 3 cwt. of barley. For dairy cows and fattening cattle or young calves over two months, 1 cwt. of beans, 2 cwt. oats, 1 cwt. wheat, and 2 cwt. of pure linseed cake. The first ration has a nutritive value of approximately 1 : 6, the second approximately 1 : 4. This second ration, except possibly for the young calves, is rather narrow and it should be possible to reduce the amount of linseed cake without interfering materially with the dietetic value of the mixture.

Use of Home-Grown Linseed for Stock.—The cultivation of a breadth of linseed for stock feeding is an increasing practice. Linseed is a valuable feeding stuff for all classes of stock It is, however, inadvisable to use it for pigs intended for bacon. Linseed as grown contains 36 per cent. of oil, and if used to any extent for pigs intended for bacon an unsuitable oily carcass will be produced. Farmers, therefore, should not use linseed in any mixtures given to pigs intended for bacon, but should confine its use to breeding stock, milch cattle and working horses.

FARM VALUES

CROPS.	Value per Ton on Farm.		Manurial Value per Ton.		Food Value per Ton.		Starch Equivalent per 100 lb.	Value per unit S.E.		Market Value per lb. S.E.
	£	s.	£	s.	£	s.		s.	d.	d.
Wheat	7	18	0	15	7	3	71·6	2	0	1·07
Oats	6	12	0	13	5	19	59·5	2	0	1·07
Barley	7	14	0	12	7	2	71·0	2	0	1·07
Potatoes	1	19	0	3	1	16	18·0	2	0	1·07
Swedes	0	16	0	2	0	14	7·0	2	0	1·07
Mangolds	0	15	0	3	0	12	6·0	2	0	1·07
Good Meadow Hay	4	5	0	13	3	12	31·0	2	4	1·25
Good Oat Straw	2	7	0	7	2	0	17·0	2	4	1·25
Good Clover Hay	4	15	1	0	3	15	32·0	2	4	1·25
Vetch and Oat Silage	1	17	0	7	1	10	14·0	2	2	1·16

DESCRIPTION.	Price per Qr.		Price per			Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.								
	s.	lb.	s.	£	s.	£	s.	£	s.		s.	d.
Wheat, British	—	—	9/3	9	5	0	15	8	10	71·6	2/4	1·25
Barley, British Feeding	—	—	8/10	8	17	0	12	8	5	71	2/4	1·25
„ Canadian No. 4 Western	30/3	400	8/6	8	10	0	12	7	18	71	2/3	1·20
„ Danubian	31/-	400	8/8	8	13	0	12	8	1	71	2/3	1·20
Oats, English, White	—	—	10/6	10	10	0	13	9	17	59·5	3/4	1·78
„ „ Black and Grey	—	—	8/10	8	17	0	13	8	4	59·5	2/9	1·47
„ Canadian No. 2 Western	29/3	320	10/3	10	5	0	13	9	12	59·5	3/3	1·74
„ „ No. 3 „	28/6	„	10/-	10	0	0	13	9	7	59·5	3/2	1·70
„ „ Feed	28/-	„	9/10	9	17	0	13	9	4	59·5	3/1	1·65
„ American	24/9	„	8/8	8	13†	0	13	8	0	59·5	2/8	1·43
„ Argentine	24/9	„	8/8	8	13	0	13	8	0	59·5	2/8	1·43
Maize, American	43/9	480	10/3	10	5†	0	13	9	12	81	2/4	1·25
„ Argentine	37/-	„	8/8	8	13	0	13	8	0	81	2/-	1·07
„ South African	38/6	„	9/-	9	0	0	13	8	7	81	2/1	1·12
Beans, English, Winter	—	—	9/6	9	10	1	12	7	18	67	2/4	1·25
„ Rangoon	—	—	7/9	7	15†	1	12	6	3	67	1/10	0·98
Peas, English, Dun	—	—	10/-	10	0	1	8	8	12	69	2/6	1·34
„ Japanese	—	—	28/-	28	0†	1	8	26	12	69	7/8	4·10
Millers' offals :—												
Bran, British	—	—	—	6	5	1	6	4	19	45	2/2	1·16
„ Broad	—	—	—	7	5	1	6	5	19	45	2/8	1·43
Middlings, Coarse, British	—	—	—	8	2	1	2	7	0	64	2/2	1·16
Pollards, Imported	—	—	—	6	2	1	7	4	15	60	1/7	0·85
Meal, Barley	—	—	—	10	2	0	12	9	10	71	2/8	1·43
„ Maize	—	—	—	10	15	0	13	10	2	81	2/6	1·34
„ „ Germ	—	—	—	9	10	0	19	8	11	85·3	2/-	1·07
„ Gluten-feed	—	—	—	8	10	1	7	7	3	75·6	1/11	1·03
„ Locust Bean	—	—	—	8	0	0	9	7	11	71·4	2/1	1·12
„ Bean	—	—	—	12	2	1	12	10	10	67	3/2	1·70
„ Fish	—	—	—	17	5	4	6	12	19	53	4/11	2·63
Linseed	—	—	—	21	17	1	11	20	6	119	3/5	1·83
„ Cake, English 9%	—	—	—	11	12	1	18	9	14	74	2/7	1·38
Cottonseed Cake, English 5½%	—	—	—	7	12	1	14	5	18	42	2/10	1·52
„ „ Egyptian 5½%	—	—	—	7	7	1	14	5	13	42	2/8	1·43
Decorticated Cotton Cake, 8%	—	—	—	11	17	2	14	9	3	71	2/7	1·38
Decorticated Cotton Meal 7%	—	—	—	12	10†	2	14	9	16	71	2/9	1·47
Coconut Cake 6%	—	—	—	8	12	1	10	7	2	73	1/11	1·03
Palm Kernel Cake 6%	—	—	—	5	15†	1	3	4	12	75	1/3	0·67
„ „ Meal 2%	—	—	—	5	2	1	4	3	18	71·3	1/1	0·58
Brewers' Grains :—												
Dried Ale	—	—	—	6	17	1	4	5	13	49	2/4	1·25
„ Porter	—	—	—	6	5	1	4	5	1	49	2/1	1·12
Wet Ale	—	—	—	1	1	0	9	0	12	15	0/10	0·45
„ Porter	—	—	—	0	18	0	9	0	9	15	0/7	0·31
Malt Culms	—	—	—	7	10†	1	14	5	16	43	2/8	1·43

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of September and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s. per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices :—N, 12s. 7d. ; P_2O_5, 4s. 4d. ; K_2O, 2s. 4d.

Marketing of Home-Produced Rabbit Carcasses.

The Ostend Style.—During the season, viz., from about the middle of September to the end of March, there is always a demand in the London Markets for home-produced rabbit carcasses dressed in the "Ostend" style. It needs only a little extra care and attention to method on the part of the home producer to secure for himself a preferential position in these markets, as dealers are almost invariably inclined to favour the British produce in preference to the imported, provided it is marketed in proper condition. "Ostend" rabbits are a far more saleable commodity than a rabbit which is sold in its skin, or than the wild rabbit dressed in the markets. Indeed, dealers at times have found it profitable to skin and dress in the "Ostend" style tame rabbits coming into the market for sale in their skins. The "Ostend" method requires that the carcass should be skinned with the exception of the hind feet; the fore feet should be tucked into the ribs and the carcasses paunched in such a manner that the belly is cut open from the top ribs halfway down only, so that the liver is covered and not likely to become detached. It should be remembered, however, that in killing rabbits which are to be dressed in this style, the jugular vein should be severed and the animal bled, as the whiteness of the flesh is thereby preserved.

The Ministry understands that certain dealers* in London are prepared to take British tame rabbits in the "Ostend" style, described above, in any number from one upwards, provided (*a*) That they are cleanly paunched; (*b*) That they have been allowed to cool before being packed; (*c*) That they are properly packed; (*d*) That they are despatched so as to arrive in the market by 6 a.m.; and (*e*) That they are sent only in the season, *i.e.*, during the cold weather from mid-September to the end of March. It is found that there is a prejudice against rabbits at other seasons of the year. It is alleged that producers are often so careless in preparing them for the market and in their methods of packing, that late consignments during the warm weather are as often as not unfit for human consumption when they reach the market.

Before consigning rabbits for the first time to any of the dealers, rabbit keepers should communicate with the firm direct, mentioning the fact that the dealer's name has been obtained from the Ministry.

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* A list of these dealers can be obtained on application to the Ministry.

Alternative Style of Dressing.—It may be of interest to include here a description of the method of marketing followed at the Ministry's Farm Settlement, Patrington, Hull, which has proved remunerative and has given satisfaction to all concerned.

After killing, the rabbits are skinned and paunched; then hung up exactly in the same way as a sheep with a stick round the back to hold the carcass open and to display the kidneys and fat. When cold and "set" each rabbit is wrapped in butter paper and a second wrapping of newspaper. The rabbits are then packed in grass mats, the largest of which are capable of holding five to six couples, weighing about 50 lb. Smaller consignments are sent in smaller mats. This method of despatch represents a great saving as against that of packing in crates or hampers. A London firm takes all the rabbits produced at the Patrington Farm Settlement, and have expressed their willingness to accept suitable lots from other senders.

The object of these notes is to show that a little extra care and trouble in marketing rabbits have their reward in the enhanced prices realised by a finished product. A detailed description of the various steps in the preparation of rabbits for the table and markets is given in the Ministry's Leaflet No. 265.

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Agricultural Labour Conditions Abroad.

THE August number of the "International Labour Review" contains an interesting article by Mr. H. M. Conacher of the Board of Agriculture for Scotland on the regulation of agricultural labour conditions in Continental Europe.

"The problem," says Mr. Conacher, "depends in some part on factors of climate, land tenure and the consumption demand of the populations." For the purposes of comparison the article divides Europe into three zones—Northern, Southern and Eastern, and Mid-Europe.

In the Northern Zone the carrying-on of agricultural operations is based on the work of the whole-time labourer. Large holdings are fairly common, and the keeping of stock is closely allied with arable farming. Great Britain and Northern Germany are the most populous countries where this industrial farming exists, and the amount of labour engaged in each country is considerable.

In the South of Europe (Spain, South Italy and Sicily) the system is one of capitalist farming based on large-scale holdings. The keeping of stock is divorced from arable farming, which tends to be exclusively a matter of grain-growing, and there is also the distinctive cultivation of the vine, olive and sugar cane. Few permanent workers are employed on such plantation systems, and the labouring classes live in large villages and seek work at the different seasons over a wide area. Hungary and Rumania are in a similar position; large estates are common, the landowner wants all his labour at certain important seasons, and little work is available in the intervals.

The Mid-European Zone is described as an area in which peasant landholders and peasant agriculture predominate. The peasant raises stock in the Alps, cultivates the vine in Italy, Spain and Southern France. and cereals in the lowlands, but wherever he is found the labour of himself and his family is the dominant factor.

Mr. Conacher goes on to discuss the conditions of the workers under the different systems, and the practicability of various forms of ameliorative measures such as land settlement and social insurance.

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Standardising Fruit in New Zealand.

AT the Annual Fruit Growers' Conference in Wellington. New Zealand, it was decided to seek powers for the Federation to take control of standardisation, marking and advertisement, and to make a levy up to a maximum of a penny a case.

Mr. J. A Campbell, Director of Horticulture, outlined the Department's proposals, which, he said, were intended as the first step towards getting standardised fruit on the market. Compulsory standardisation was not any part of the scheme, at present. What was wanted, he said, was the elimination of the rubbish from the market. The growers' position was absolutely critical, and a continuance of the present state of things must lead to the bankruptcy of many hard-working men. Leaflets were being issued by the Department urging:—1. The adoption of the existing standardised regulations; 2. Packing in accordance with those grades and the use of the proper labels; 3. Salesmen to display standardised fruits separate from unstandardised; and 4. Not to offer standardised fruit for sale until it had been inspected by the Fruit Inspector of the Department, who would either pass, regrade or transfer it to unstandardised, so that buyers may be able to rely on the quality of fruit bearing the label of standardisation.

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List of Potato Varieties.—A note in this *Journal* for October, 1923, p. 669, announced that the Board of Agriculture for Scotland had prepared a list of all potato varieties. It should, however, have been stated that the price of the list is 2s. 6d., post free, from the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

Courses at Farm Institutes.—The statement below shows the courses to be held during the 1923–4 session at Farm Institutes recognized by the Ministry. A note on the purposes of Farm Institute courses appeared in the *Journal* for September, 1923, p. 485.

Name and location of Institute.*	Description of Courses	Fees. (Board, lodging and tuition unless otherwise stated.)
Cheshire : Cheshire School of Agriculture, Reaseheath, near Nantwich.	(a) Winter Courses, of about 22 weeks' duration, in Agriculture and Horticulture. (b) Short courses in Dairying and Poultry-keeping. (c) Courses, intended for beginners, of practical training in farm or garden work.	Students resident in county, 1l. per week. Other students, 1l. 15s. per week.
Cumberland and Westmorland Farm School, Newton Rigg, near Penrith.	(a) Winter Course (Agriculture) of 20 weeks, October to March, in science and practice of Agriculture with special reference to Dairy-farming and Stock-rearing. (b) Three Summer Courses (Dairying and Poultry-keeping) of from 4 weeks' to 12 weeks' duration. April to September. (c) Special pupils are admitted for practical training in Farm Management.	Westmorland students Cumberland students } 1l. per week. Students from other counties 2l. per week.
Essex : East Anglian Institute of Agriculture, Chelmsford.	(a) Winter School of Agriculture of 20 weeks' duration, October to March. *Note.*—There is no farm attached to the Institute. All students previous to attending this course must spend at least one year on a farm, taking an active part in all farming operations.	(a) Residents in administrative county of Essex and County Borough of Southend, 5l. for 20 weeks. Students from outside the county, 1l. per week.
	(b) Dairy School. Three courses of from 12 weeks' to 16 weeks' duration. N.D.D. 2 years' course (6 terms); also qualifies for diploma of B.D.F.A.	(b) Residents in administrative county of Essex and County Borough of Southend, nil. Pupils from outside the county, 15s. per week.
	(c) School of Horticulture. Course of three terms, viz., Autumn Term, 3 weeks; Spring Term, 4 weeks; Summer Term, 4 weeks. Practical instruction is given at the County Gardens.	(c) Residents in administrative county of Essex, and County Borough of Southend, nil. Students from outside the county 15s. per week.

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* Further particulars may be obtained in each case from the Principal of the Farm Institute.

Name and location of Institute.*	Description of Courses.	Fees. (Board, lodging and tuition unless otherwise stated.)
Hampshire : Sparsholt Farm Institute, near Winchester.	Instruction in Agriculture, Horticulture, Poultry-keeping, Dairying and Bee-keeping. (*a*) One year's course in above subjects :—Winter Course of 24 weeks, October-March. Summer Course of 15 weeks, April-July. (*b*) One year's course should be taken in preparation for the B.D.F.A. (Butter and Cheese) certificate examinations. (*c*) Short courses can be arranged in special subjects.	Students resident in administrative county of Hampshire, 1*l*. per week. Other students, 1*l*. 15*s*. per week.
Hertfordshire : Hertfordshire Agricultural Institute Oaklands, St. Albans.	(*a*) One year's course in Agriculture, of three terms, commencing respectively October, January, May. (*b*) Dairying Courses (i.) One year's course, commencing October. (ii.) Summer Course, April to August. (iii.) Short courses in Special Dairy Subjects (Clean Milk Production, Soft Cheese making and Disposal of Surplus Milk). (*c*) 12 weeks' course in Horticulture extendable to one year. (*d*) Two one month courses in Agriculture for non-residential students in December and January respectively. (*e*) 20 weeks' course in Poultry-keeping extendable to one year.	Students resident in county, 1*l*. 15*s*. per week. Students from other counties, 2*l*. 10*s*. per week. Day students, 10*s*. per week.
Northamptonshire : Northamptonshire Farm Institute, Moulton, Northampton.	(*a*) Winter Course of 22 weeks (October to March) in the science underlying the practice of Agriculture. (*b*) Summer Course, for Women, of 10 weeks (May to July) in Dairy Farming. (*c*) A limited number of Farm pupils can be taken from April to October for practical training in mixed farming with special reference to Live Stock Husbandry.	Resident pupils :— (1) From Northamptonshire, 23*s*. per week. (2) From outside the county, 31*s*. 6*d*. per week. Non-resident pupils :— (1) From Northamptonshire, 5*s*. per week. (2) From outside the county, 10*s*. per week.
Somerset : Cannington Court Farm Institute, Cannington, Bridgwater.	(*a*) Agriculture and Horticulture, one year's course, three terms each of 12 weeks' duration. (*b*) Dairying and Poultry-keeping —Full course, 12 weeks; short courses, 4 weeks.	Somerset students, 18*l*. per term. Other students, 28*l*. per term. (For short courses, 1*l*. 15*s* and 2*l*. 10*s*. per week respectively.)
Staffordshire : Staffordshire Farm Institute, Rodbaston, Penkridge, Stafford.	(*a*) Winter Course in Agriculture for youths from 16-20 years, 22 weeks (October to March). (*b*) Summer courses for women in Dairying, Poultry-keeping, Bee-keeping and Horticulture, 11 weeks (April-July).	Fees for Winter Course—Tuition fee all students, 5*l*.; maintenance fee, students resident in administrative county of Stafford, 25*l*.; students from outside the county, 45*l*.; day students, 7*l*. 10*s*.

Name and location of Institute.*	Description of Course.	Fees. (Board, lodging and tuition unless otherwise stated.)
Staffordshire—*cont.*		Fees for Summer Course—Inclusive fee for students resident in administrative county of Stafford, 12*l.*; students from outside county, 20*l.*
Chadacre Agricultural Institute, Hartest, Bury St. Edmunds, Suffolk.†	(*a*) Course in Agriculture for male students comprising two Winter Sessions of six months (two terms) each. (*b*) Spring and Summer Courses (nine weeks each) in Dairying, Horticulture, Poultry-keeping and Bee-keeping, for women students.	Male students — FREE tuition, board and residence to selected students. Female students — resident in the county of Suffolk; tuition and residence FREE, board 15*s.* per week. Students resident outside the county of Suffolk; board residence and tuition 25*s.* per week.
Carnarvonshire: Madryn Castle Farm School, Pwllheli.	(*a*) Winter Course in Agriculture for men (20 weeks), October to March. (*b*) Summer Course in Dairying, Poultry-keeping, Bee-keeping and Domestic Science for women (12 weeks), April to July.	(*a*) Carnarvonshire students, 17*l.* 10*s.* Other students, 30*l.* (*b*) Carnarvonshire students, 10*l.* 10*s.* Other students, 18*l.* Special Course, 35*s.* per week.
Denbighshire: Llysfasi Farm Institute, Ruthin.	(*a*) Autumn Course in Agriculture for men (8 weeks), October to December. (*b*) Winter Course in Agriculture for men (8 weeks), January to March. (*c*) Spring Course in Dairying, Horticulture, and Poultry-keeping for women (8 weeks), April to June. (*d*) Summer Course in Dairying for women (8 weeks), July to August.	Board, lodging, and tuition to residents in the County, 22*s.* 6*d.* per week. Non-residents, 25*s.* per week.
Monmouthshire Agricultural Institution, Usk.	(*a*) One year's Certificate Course. (*b*) Two years' Diploma Course. Winter Term of 22 weeks (October to March). Summer Term of 22 weeks (April to September). These courses include all branches of Agriculture. Students may specialise in General Agriculture, Dairying, Poultry-keeping and Commercial Horticulture, the last named subject being a particular feature.	Tuition, board and residence:— 15*l.* per session (22 weeks) for Monmouthshire students; 32*l.* 10*s.* for other students. Tuition only:—— 2*l.* per session for Monmouthshire students; 5*l.* for other students.

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† The authority responsible for this Institute is the Trustees of the Earl of Iveagh's Foundation.

Grants for Agricultural Research.

The Ministry, with the approval of the Development Commissioners and the Treasury, has awarded the following special research grants for work in connection with agricultural problems during the Academic year October, 1923, to September, 1924. These grants are in addition to the annual grants in aid made to Universities and Research Institutes for the maintenance of agricultural research departments,

Institution.	*Investigation.*	*Amount.*
Armstrong College, Newcastle	Research in composition of oat straw (6 months)	£ 120
Cambridge, School of Agriculture	Soil bacteriology	300
Cambridge, School of Agriculture	Statistical examination of milk records	250
Imperial College of Science & Technology	Change of seed in potatoes	60
Imperial College of Science & Technology	Mosaic disease of hops (6 months)	170
Waltham Cross Experimental Station	Fertilising effect of carbon dioxide	300
Wye, South-Eastern Agricultural College	Turnip and Swede seed beetles	120
Aberystwyth, University College of Wales	Nutritive value of grasses	150
Bangor, University College of North Wales	Dry rot of swedes	165
Bristol University	Striking of cuttings	50
Edinburgh University Animal Breeding Research Department	Breeding experiments with merino sheep	700
Imperial College of Science & Technology	Investigation of flea beetles	200
Imperial College of Science & Technology	Physiological effects of insecticides	270
Leeds University	Healing of wounds in woody plants	20
Leeds University	Breeding experiments on the colour of Wensleydale sheep	100
Midland Agricultural and Dairy College	Labour force required in production of crops, etc.	175
Oxford, School of Rural Economy	Nitrogen yield in certain soils...	275
Wye, South Eastern Agricultural College	Wild white clover investigation	300
	Total ...	£3,725

Lectures on the Rothamsted Experiments.—The Director of the Rothamsted Experimental Station, Harpenden, announces that during the forthcoming winter it will be possible for Mr. H. V. Garner, the Guide Demonstrator of the Institution, to give a few lectures to Chambers of Agriculture and Horticulture, Farmers' Clubs, Agricultural Societies, etc., on the Rothamsted Experiments in regard to:—(1) Manuring of Root Crops and Potatoes, (2) Manuring of Cereals, (3) Manuring of Grass Land, (4) Manuring of the Rotation, (5) The Management of Farm Yard Manure, (6) Chalking and Liming, (7) The carrying out of Field and Feeding experiments.

Any such association wishing to avail itself of Mr. Garner's services is invited to communicate with the Secretary of the Station, indicating the subject or subjects which would be of most interest to its members, and convenient dates. No fee will be charged for Mr. Garner's services, but any association engaging him would be expected to defray his travelling expenses and to make such arrangements for the lecture as may be necessary.

Foot-and-Mouth Disease.—*Buckinghamshire and Devonshire.*—No outbreak having occurred in either of these counties since 14th and 12th September, respectively, the remaining general restrictions imposed by Orders of the Ministry were withdrawn in the case of Buckinghamshire as from 19th October and in the case of Devonshire as from 16th October.

Fresh Centres.—Since the October issue of the *Journal*, fresh centres of foot-and-mouth disease have appeared in the following places:—

(1) 23rd September, at Whitchurch, Nr. Bristol, Somerset.
(2) 23rd September, at Grimsby (Lindsey), Lincs.
(3) 28th September, at Ipstones, Nr. Leek, Staffs.
(4) 1st October, at Barnoldswick, Yorks (W.R.).
(5) 1st October, at Adney, Nr. Newport, Salop.
(6) 1st October, at Cranleigh, Surrey.
(7) 6th October, at Hatfield Heath, Harlow, Essex.
(8) 10th October, Nr. Leeds, Yorks (W.R.).
(9) 12th October, at North Farnborough, Hampshire.
(10) 12th October, at West Hoathly, East Grinstead, East Sussex.
(11) 13th October, at Wigan, Lancs.
(12) 20th October, at Sprowston, near Norwich, Norfolk.
(13) 25th October, at North Burton, Bridlington, Yorks.

Origin.—No definite origin has been discovered for the initial outbreaks in the above-mentioned centres (1) to (7), (9) and (10).

Yorkshire.—The outbreaks near Leeds, centre (8), were attributable to the exposure of animals in the incubative stage of the disease at Whitkirk Auction Marts on 1st and 8th October, and in Skipton Market on 24th September. Animals connected with the first Barnoldswick outbreak were exposed at Skipton Market on 24th September, and animals purchased at Skipton Market were taken to the Leeds district, the purchaser subsequently exposing animals from his premises at Whitkirk Auction Marts on the dates mentioned. As distribution from these markets was considerable the Ministry imposed restrictions on movement over practically the whole of the West Riding and some adjoining portions of the East and North Ridings of Yorkshire. Other outbreaks have followed, directly attributable to the same source. It appears from first reports that infection was conveyed to the East Riding from the Leeds district before the Leeds outbreak was reported.

Lancashire (Wigan).—When the reported outbreak at Wigan was confirmed on 13th October it appeared from inquiries that certain of the diseased animals had been exposed at Chester Market on 9th or 11th October, and that the animals were possibly in an infective stage when at that market. In these circumstances the Ministry considered it necessary to impose a Prohibition of Movement Order over the whole of the area of distribution from Chester Market, including the remaining portions of Lancashire, Cheshire, Flintshire and Denbighshire not already under foot-and-mouth disease restrictions, and also a small part of Carnarvonshire. From later information it appeared that there might be another channel by which infection was conveyed to the animals brought from Chester Market after arrival at Wigan, and pending the confirmation of this possibility the Prohibition of Movement Order was modified so as to allow movement by licence in the area referred to, except within a radius of 5 miles of Wigan. This modifying Order took effect on 16th October.

Summary of Outbreaks.—(27th August–25th October, inclusive. The following shows the number of outbreaks which have occurred in various counties since the present series of outbreaks commenced on 27th August:—

County.	*No. of Outbreaks.*	*County.*	*No. of Outbreaks.*
Buckinghamshire ...	5	Lincs (Lindsey) ...	1
Cheshire	25	Norfolk	3
Denbighshire	4	Salop	14
Devonshire	4	Somerset	7
Essex	5	Staffordshire	1
Flintshire	9	Surrey	3
Gloucestershire ...	1	East Sussex	1
Hampshire	7	Yorkshire (E.R.) ...	1
Lancashire	19	Yorkshire (W.R.) ...	28
		Total	138

No. of Animals slaughtered.—The total number of animals slaughtered in connection with these outbreaks is as follows:—

Cattle.	*Sheep.*	*Pigs.*	*Goats.*
4,061	5,910	2,532	9

Compensation.—The gross compensation (estimated) payable for these animals will amount to about £134,000, but it is estimated that about a quarter of this sum will be recouped by the salvage of healthy carcasses.

Restrictions on Movement.—The appearance of fresh centres has necessitated the imposition of restrictions covering the usual 15 miles radius, but as indicated above, this radius had to be extended in the case of Yorkshire, Lancashire and Cheshire, where important markets appeared to have been infected.

Warning to Farmers, etc.—The appearance of new centres of the disease of unaccountable origin in widely separated localities is very disturbing, and notices have been issued through the Press and the Branches of the National Farmers' Union, to farmers and dealers in live stock, impressing upon them the importance of keeping a close watch upon their animals and reporting at once to the Police any suspicious symptoms on the mouth or feet of stock. Assistance has also been rendered by the British Broadcasting Co. in bringing to the notice of farmers and others "listening in," through the medium of the wireless news bulletins, the Orders made by the Ministry in certain of the districts. This was notably the case on Saturday and Sunday evenings, 13th and 14th October, in connection with the issue of the Prohibition Order over South Lancashire, Cheshire and North Wales, at a moment when there were the usual week-end difficulties of publishing urgent Orders of this nature.

Leaflets issued by the Ministry.—Since the date of the list given on page 377 of the July issue of the *Journal*, the following new leaflets have been issued.

No. 184.—Alsike Clover.
„ 332.—Carnations.
„ 399.—Red Clover.

The following leaflets have been revised.

No. 21.—The Warble Fly.
„ 105.—Wart Disease.
„ 192.—Farm Butter-making.
„ 266.—Ropy Milk.
„ 295.—Marketing of Eggs.
„ 302.—Silver Leaf Disease in Fruit Trees.
„ 331.—The Canning of Fruit and Vegetables.
„ 366.—The Manufacture of Whey Butter.

The following leaflets have been re-written.

No. 182.—Crimson Clover.
„ 280.—Sainfoin.
„ 294.—The Housing of Laying Stock.
„ 317.—The Rearing of Chickens.

Technical Advice for Farmers.—The Development Commissioners and the Treasury have agreed to an expenditure of £28,500 in the year 1923–4 on the maintenance of Advisory Officers in entomology, mycology, chemistry, and veterinary science, at the thirteen Provincial Advisory Centres established by the Ministry of Agriculture. These are at Aberystwyth, Newcastle-on-Tyne (Armstrong College), Bangor, Bristol, Cambridge, Cardiff, Newport (Salop, Harper Adams College), Leeds, Manchester, Sutton Bonnington (Notts, Midland College), Reading, Newton Abbot (Devon, Seale Hayne College) and Wye; ten centres in England and three in Wales. At each, there will now be an Entomologist and a Mycologist, and at seven of them there will be Chemists, and at three, Veterinarians. The Centres which are on this occasion having additions made to their staffs under this scheme are Harper Adams College, which gains an Entomologist, Armstrong College, Bristol University, Seale Hayne College, each of which gain a Mycologist, and Armstrong College and Bangor College, which will have new Veterinary Advisory Officers.

This position represents a distinct and noteworthy advance in the scheme for the provision of advice to farmers on technical matters. The organisation of that scheme, as may be remembered, is on the basis of the County, the Province and the Research Station. In the County, the Agricultural Organiser is the chief officer and he is usually in charge of an expert agricultural staff, competent to deal with inquiries from farmers and others on points of recognised agricultural practice. The Province consists of a group of counties ranged round the Agricultural Department of a University or an Agricultural College, the staff of which Department is available for advising agriculturists on the more intricate and difficult problems of agricultural practice. Such advice, however, is usually passed on to farmers through the County Agricultural Organisers. Attached to the University Department or College Staffs are the special Advisory Officers, whose numbers are given above, who devote the whole of their time to the investigation of special problems confronting farmers in the Province and to advising according to the results of their investigations and their knowledge.

Agricultural Research Scholarships.—The Ministry, on the recommendation of the Advisory Committee on Agricultural Science, and with the concurrence of the Development Commissioners and the Treasury, has awarded *Research Scholarships*, of the value of £200 per annum, and tenable for three years, to the following candidates:—Mr. D. I. Evans (University College, Aberystwyth, for Plant Physiology); Mr. I. A. Galloway (Royal (Dick) Veterinary College, Edinburgh, for Veterinary Science); Mr. R. P. Hobson (London University, for Chemistry); Mr. J. P. Maxton (Glasgow University, for Economics); Mr. J. H. Motion (Edinburgh University, for Animal Pathology); Mr. Wm. Williams (University College of North Wales, Bangor, for Chemistry); Mr. S. S. Willimott (Imperial College of Science and Technology, for Chemistry).

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REPLIES TO CORRESPONDENTS.

Sainfoin.—L.N. asks what crops should follow sainfoin and how long before sowing the new crop a sainfoin ley should be ploughed up.

Reply: As stated in Leaflet No. 280, barley, on light soils, follows it with great advantage and on thin, dry soils unsuitable for turnips, rape and mustard often follow sainfoin successfully. On other soils there is a wider choice, but it is advisable to select a crop less susceptible to wireworm which is usually rather prevalent in a ploughed up sainfoin ley. Wheat, for this reason, is not often taken after sainfoin, but it is not unusual after ploughing up the ley in the autumn and leaving it to weather during the winter to sow oats in the spring. In that case the application of manures at seed time will generally carry the crop over the danger of wireworm attack. Beans are also taken after sainfoin and also, if the soil is suitable, turnips or potatoes. At any rate the ley should be ploughed up as early as possible and left during the winter.

Farm Values of Home Grown Feeding Stuffs.—B.A. asks how to work out farm values of cabbages and beans.

Reply: The method of working out the food values per ton is partly explained in Leaflet No. 396. For hay and straw, however, instead of taking the (starch equivalent) unit value for maize, the unit value for dried brewers' grains is taken. For vetch and oat silage the average between the two (maize and dried brewers' grains) is taken. The manurial values are based on figures in Bulletin No. 73 of the University of Leeds and the Yorkshire Council for Agricultural Education. The starch equivalent is taken from column 15 (net digestible energy as starch) in the Ministry's Miscellaneous Publication No. 32 ("Rations for Livestock"). The protein content is not used in estimating cash values but, as explained in Leaflet No. 388, needs to be considered in compounding rations.

Moisture Content of Cereals.—C.B. asks what is the moisture content of cereal grains.

Reply: Figures for the average marketable product, given in the Ministry's Miscellaneous Publication No. 32 ("Rations for Livestock") are between 13 and 15 per cent. At the time of threshing the figure is very variable. It may be over 20 per cent. if the crop has been got in under bad weather conditions or it may be about 13 per cent. Afterwards the figure varies with the weather and in a damp spell the grain can easily absorb a few per cent. of moisture.

Eradication of Fleabane.—D.C. asks for information.

Reply: Common Fleabane (*Pulicaria dysenterica* Gaertn.) grows on moist road sides, ditch banks and badly drained pastures and increases chiefly by means of a creeping root-stock, which is not extremely deep-seated. Occurring as it does on clayey soils or on sandy soils over clay, thorough drainage is of great value in its eradication. Persistent cutting with a scythe (see paragraph 4 (b) on page 5 of Leaflet No. 112) will greatly weaken the plants by preventing the storage of food for future use. Ploughing up and cultivation of an infested field offer the best chance of permanently cleaning the land.

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NOTICES OF BOOKS.

The Journal of the National Institute of Agricultural Botany. No. 1, 1922.—(Published by the Institute, Huntingdon Road, Cambridge, price 1s.) The appearance of this new Journal is the result of a decision of the Council of the Institute to collect in one annual publication the reports of all scientific work carried out by the different branches, and to include a brief statement of the proceedings of the Fellows of the Institute. The Journal includes the reports of trials carried out in 1922, together with the reports of the Official Seed Testing Station for England and Wales and of the Potato Synonym Committee, which have been hitherto published separately. The present publication will appear every spring, while the Annual Report of the Council and the Accounts will continue to be issued in the autumn.

Elementary Agricultural Science.—(William Smith. London: Oliver and Boyd.) This little book extends to about 175 pages and contains 61 illustrations. It deals with agricultural science in a simple manner, to meet the needs of pupils who are still at school and require guidance of a more elementary character than is supplied in the many existing good books of a more advanced type. It is really a suggestive outline of principles, intended to inspire the pupil with a wish to learn more about agriculture. To this end it deals briefly with soils and their cultivation, the plant and its growth, manuring, the various crops, rotations, crop diseases and pests, and weeds of the farm. At the end of each chapter is given a short series of questions which the pupil can usefully set himself to answer. Mr. Smith's work can safely be placed in the hands of young people between the ages of 9 and 18.

Guide to Current Official Statistics.—(First issue, 1922, pp. 162, H.M. Stationery Office, price 1s.) This guide has been prepared at the instance of the Permanent Consultative Committee on Official Statistics, and aims at enabling persons who are using these statistics to ascertain readily what has been published during the year on any particular subject.

The guide is divided into two parts: (1) a list of publications containing statistics grouped, usually, under the respective public departments, and (2) a subject index to the publications included in (1). In addition to this, by a system of cross reference under the main headings of the subject index, a ready means is provided of tracing a publication on a relatively minor subject. In an introduction general instructions for using the guide are given.

This book and the subsequent issues will be a great assistance, indeed a necessity, to those engaged in statistical research or to others whose work involves the consultation or use of official statistics.

The Farmer's Raw Materials.—(James Hendrick. Edinburgh: W. Green & Son, Ltd., 1923, 211 pp., 6s.) This is the second of the new Scottish Series of Junior Agricultural Text-books, of which Farm Book-keeping by John Kirkwood has previously appeared, while Dairy Farming by Professor R. H. Leith will follow shortly. It is pointed out in the general preface that while higher agricultural students of University standard are well supplied with excellent text-books, few up-to-date manuals exist which are suitable for students of the intermediate grade attending Farm Institutes, extension lectures at agricultural colleges, or similar courses. While the series is intended to have as its viewpoint the agricultural and educational conditions peculiar to Scotland and the north of England, the bulk of the material will be of general application, and to judge from the standard of the two books already issued, there is good ground for the hope expressed that the publications will be found useful further south.

The author of this simple but informative account of the farmer's raw materials—air, water, soil and manure—who is also the general editor of the series, is too well known by his work at Aberdeen University for this small work to need any special recommendation. Suffice it to say that the book is intended to convey in a simple, readable manner such knowledge as is necessary to the farmer in order that he may use to the best advantage his four primary raw materials. The subject of manures, the importance of which is especially emphasised, receives particularly full treatment. The use of a certain number of chemical terms has necessarily been unavoidable in a work of this kind, but they have been limited as far as possible to those which should be familiar to every farmer and to the average boy who has received a modern elementary school education.

Foundations of Agricultural Economics—(J. A. Venn, M.A., Cambridge University Press, 1923, pp. 397, 16s. net.) This book might, perhaps, have been more fitly entitled "The Historical Foundations of Agricultural Economics," for it is the foundations in history, rather than in economics, with which it deals. Thus in the two chapters on that important subject in the economics of agriculture—the size of holdings—the treatment is mainly of an historical or generally descriptive character, only a few pages being concerned with this question in relation to cost of production or to other economic aspects of the subject. Similarly, the sections dealing with the fluctuations in agricultural prices between 1914 and 1922, although giving a general account of the rise and fall in prices, are almost without a reference to the fundamental economic theories, upon which such price movements are now generally believed to depend. But these are slight criticisms of a book so admirably arranged and so full of information as this is; nor can we pass over the question of the size of holdings, without reference to the extremely interesting section and tables dealing with the relative yields from large and small farms in Rumania, the only country in Europe to compile such statistics.

The book has one great merit—it is very readable. The first two chapters give a concise and attractively written account of the various systems of land tenure from the earliest times down to the present day, and the chapters dealing with "Tithe" and "Land Tax, Rates and Income Tax" are both excellent and informative. It is, perhaps, to the chapters on "Agriculture in

Peace and War," and "The Wheat Supply of the United Kingdom," that the reader will turn with most interest. In the former, an account of the "ploughing up campaign" undertaken by the Food Production Department, with a description of the organisation, and an analysis of its effect, is given. It is followed by a discussion of the difficulties of maintaining the increased arable area thus brought into being, after the fall in prices, which began in 1920, had set in. In the chapters on the wheat supply, a short historical survey is followed by an historical account of the various attempts that have been made to maintain corn prices by legislation, and the circumstances which led to, and the results which followed, the repeal of this legislation.

An excellent account of Agricultural Co-operation is given in a chapter on this subject, comparing the widely different forms co-operation has assumed in different countries.

A chapter on agricultural statistics, again treating the subject from an historical point of view, and some useful appendices, conclude this admirable and scholarly book.

Farm Live Stock of Great Britain.—(Professor Robert Wallace assisted by Professor J. A. Scott Watson. Edinburgh and London: Oliver and Boyd, 5th Edition, 1923, 868 pp., 30s. net.) The new edition of this widely appreciated work, which deals with the most important section of our farming system, is notably issued in the joint names of two successive Professors of Agriculture at Edinburgh University—the first British University to grant a degree in agriculture. Though it extends to 868 pages and contains 442 plates and 111 text figures, it is not to be regarded as containing an exhaustive account of every breed. It does, however, give such an account of all breeds of horses, cattle, sheep, goats, pigs and sheep dogs as will suffice to meet the needs of most farmers and students, and is undoubtedly the finest single volume of its type published within the Empire.

As an example it may be remarked that Devon and South Devon cattle are dealt with in 9 pages, consideration being given to origin and history description, distribution, economic value for beef and milk, and prominent breeders. The principles of live stock breeding cover 18 pages; the breeds of cattle 230 pages; such matters as calves, grazing cattle and their diseases, house-feeding of cattle, dairying and management of dairy cows, 125 pages. Other classes of farm live stock are dealt with on similar generous lines, and there are numerous appendices of considerable value and interest. The illustrations are, in the main, of the highest degree of excellence, but in a few cases—as is so common in photography of this class—the animal is placed before a bad background which breaks the outline and renders it indistinct. Altogether this volume can safely be regarded as a sound work of reference.

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ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Smith, W.—Elementary Agricultural Science. (175 pp.) Edinburgh and London: Oliver & Boyd, 1923. [63(022).]

Stoklasa, J.—Die Beschädigungen der Vegetation durch Rauchgase und Fabriksexhalationen. (510 pp.) Berlin: Urban & Schwarzenberg, 1923. [614.7; 58.11(02).]

Field Crops.

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Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W.1.

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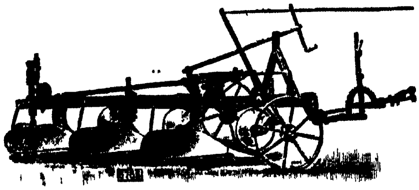

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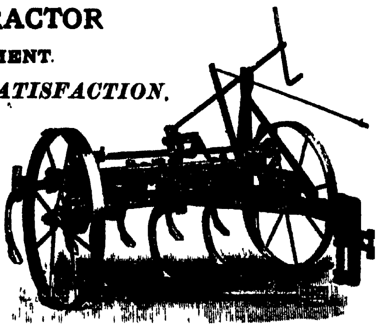

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THE JOURNAL
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Vol. XXX. No. 9.

DECEMBER, 1923

NOTES FOR THE MONTH.

Government's Agricultural Policy.

Sir Robert Sanders, Minister of Agriculture, outlined the agricultural policy of the Government at a meeting at Cirencester on the 15th November, 1923. He said, if returned to power, the Government proposes to give a subsidy of £1 an acre on all arable land to occupiers of holdings of more than one acre in extent. Market gardens and land under fruit and hops are included. One of the main objects of the subsidy is to prevent increasing unemployment, and the consequent fall in wages. It will, therefore, not be given to any farmer who pays a wage of less than 30s. a week to able-bodied adult workers. When wages rule above that minimum, it is confidently hoped and expected that the labourers will, in the ordinary course, obtain in their wages their share in the benefit of the subsidy.

"In this regard it rests with the farmers to prove in practice that wages boards are unnecessary for that purpose. But the Government must reserve the right in cases of necessity to establish machinery to ensure that a fair wage is paid. This is not the time to go into details, but I ought to say that it will be necessary to make provision to prevent rents being raised on account of the subsidy. That raises the question whether, if a subsidy is given, it should be given upon acreage or upon the amount of production.

"The Government have decided, and, I think, rightly, in favour of giving it for acreage, because, if you give it according to the amount of production, then the man who is cultivating the best land, and consequently gets the best crops, gets the greatest advantage. What we want to do is to keep the poor land under the plough, and it is only by making this arrangement upon the basis of acreage that you can ensure that being done. This scheme ensures the minimum of Government control. The Ministry of Agriculture have had considerable experience in this matter of inspection and Government control, and

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they have deliberately arrived at the conclusion that a subsidy on the basis of acreage leads to very much less control and interference than a subsidy on the basis of production.

"We all hate inspection and control. We all hate seeing Government officials about the place. We believe that such a system as I have foreshadowed is the system by which you can best give real assistance to arable cultivation, and at the same time ensure the minimum of red tape."

Sir Robert Sanders said there was a measure in connection with which he had come in for a considerable amount of criticism, and that was the proposal to put a duty on imported malting barley. When Mr. Bonar Law was Prime Minister that was announced as part of the policy of the Government. Their intention then was to put an Excise duty, a duty collected within the country, upon imported malting barley. It was ascertained that there were certain treaties with foreign countries which prevented them from doing that at once. They then set to work to see whether they could not do it by means of a Customs duty, and the Committee which had lately been sitting had found a way, and one which he thought was workable, practicable, and satisfactory, in which they might impose that duty by means of a Customs instead of an Excise duty, and it was the intention of the Government, if returned, to put a Customs duty on malting barley.

* * * * * *

The Second Interim Report of the Agricultural Tribunal.

THE recommendations made in the First Interim Report of the Agricultural tribunal of Investigation were summarised in this *Journal* for May last, p. 110. The Tribunal was appointed on 29th December, 1922, "to inquire into the methods which have been adopted in other countries during the last fifty years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labour at a living wage, and to advise as to the methods by which those results can be achieved in this country."

The Second Interim Report* was issued on 17th November. It recalls that the decline in the arable area is no new thing, as, with the exception of the years 1916-1920 and save in individual years, there has been a steady decline during the last fifty years. In 1873 the arable area in Great Britain was 18,186,671 acres; in 1923 it is 14,478,013 acres, a decline of

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* H.M. Stationery Office, Cmd. 2002, 3d. net.

3,708,658 acres, or 20 per cent. A great part of this decline is due to a shrinkage of over 48 per cent. in the wheat area. The movement shows no sign of slackening. The Tribunal state that they would view with grave concern any substantial decrease in the present arable acreage of the country, since the maintenance of that area is an important factor in the maintenance up to pre-war level of the home production of food, and of the employment of labour.

The Tribunal express the view that "if the decline in the arable area is to be at least checked, immediate direct action by the Government is necessary. If left to itself the farming industry will necessarily adjust its practice so as to make farming pay. But under present circumstances it will be farming of a character which will involve a material reduction in the supply of home-grown food and a serious decline in the number of men employed on the land, thus adding yet further to the burden of unemployment." They come definitely, though reluctantly, to the conclusion that, in order to maintain the agricultural area, either a guarantee or a subsidy would be necessary.

Discussing the question of a subsidy or guarantee the Tribunal point out that the unequal incidence of a subsidy is inherent in any scheme that may be devised. They suggest alternative methods:—(1) a subsidy on each acre of arable land in excess of 12,000,000 acres, this being the arable acreage below which the total in Great Britain is not likely to fall; (2) a subsidy of £1 per acre on the whole arable area; (3) a guaranteed price to the farmer for his wheat—a subsidy on output; (4) an acreage subsidy on wheat, thus not penalising poor land; (5) a subsidy on wages by a contribution from the State to the farmer's labour bill; and (6) that land under the plough should be given assistance through partial relief from national taxation. Discarding certain methods as being administratively difficult, or unequal in their incidence, or encouraging all types of farming instead of arable farming in particular, the Tribunal prefer a scheme which combines a subsidy on all arable land with an additional subsidy on land under wheat. They therefore recommend a subsidy of 10s. per acre on all arable land as defined (that is, all land ploughed during the year, including summer fallow, but excluding land under clover and grass seeds, small fruit, orchards and hops) and an additional subsidy of 10s. per acre on all land under wheat.

In making their recommendation the Tribunal are of opinion that "in order to place a premium on good farming the Minister of Agriculture should have power to reduce or withhold altogether the subsidy in cases where he is satisfied that the farmer has not cultivated his holding according to the rules of good husbandry as defined in the Agriculture Act, 1920, and we consider that the County Agricultural Committees should be charged with the duty of furnishing the Minister with the necessary information."

The Tribunal renew and emphasize the recommendations in their First Interim Report with regard to the creation of district Agricultural Wages Boards, as they "could not contemplate a subsidy to agriculture unless a considerable portion of the benefit thereby accruing to the industry was in fact enjoyed by agricultural workers."

* * * * * *

Pigs for Bacon.

THERE is a great need for an increase in the number of pigs kept in this country, and particularly of high-grade bacon pigs. In order to create an interest in this side of farm produce, a number of articles have been published in this *Journal* in recent months. In this issue appear two such articles, one of which is especially devoted to the production of bacon pigs. It is hoped that the latter is a sound statement of what most farmers need to know regarding the points of a bacon pig, and that with this before them they will have less difficulty in producing what the curer wants. It is not a question of breeding an improved variety of pig: the Danes, so often held up as models, use British pedigree boars for producing their bacon pigs. Nor is it a question of nature of food, for the Danish pig is fed on standard lines—largely with foreign barley. Yet the difference in the results is striking.

The view is held that, whereas at least three-quarters of the Danish pigs give first quality bacon, less than one-quarter of the English pigs reach that standard.

It would appear that the Danes secure their results by the adoption of the following methods:—

1. Concentration on the single aim of producing a side of bacon pig for the English market, without considering the pork pig.
2. The co-operative and State control of the whole business from start to finish. Beginning with the boars, they do what is in accord with modern views on genetics. For example, boars *whose progeny* do not come up to a certain standard are

slaughtered. In other words, the test applied is *progeny*, not pedigree. Further, the standard is not a fancy one based on external points. It depends mainly upon precise measurements of the carcass, and consideration is given also to such matters as early maturity, capacity of flesh to take up salt readily, distribution of fat and lean.

It is clear that the Danes have succeeded because they have organised the whole business of bacon production, from breeding to curing and marketing. In this country there is a lack of unity of aim or effort. Some farmers aim at producing the "porker," and only carry it on to bacon weights when the pork market is bad. Others are thinking of the pedigree trade, and "points" have too often been determined by the fancy of judges and breeders without sufficient consideration of the economic aspect of the carcasses.

Some excuse for the farmers' attitude, however, is to be found in the confusion between the requirements of pork butcher and bacon curer respectively, which have not been clearly defined in the markets. Again, bacon curers have not always paid a better price for the good bacon pig. As Professor Wood pointed out in the course of a discussion at Cambridge last May, the farmer is insufficiently in touch with the consumers' market. Just as Professor Biffen made an advance in wheat breeding by consulting the miller, so progress in other branches of technical knowledge will be promoted by co-operation with persons engaged in the actual businesses which handle the farmers' raw materials.

The conclusion of the whole matter seems to be that there is one procedure which may go a long way to remedy the existing state of affairs. We need more standardisation of our production. What the English market requires and appreciates is *a regular supply of a standard product*—whether it be cheese, butter, fruit, bacon or corn. It is the finest market in the world. The irony of the position is that the best English produce is still superior to anything coming from abroad. The best Wiltshire bacon still commands the highest price, but no one can undertake a future delivery of regular supplies of uniform quality. Yet as Mr. J. M. Harris has pointed out, the Danes can contract to supply sides by the thousand, all of one quality. Co-operative societies, after all, are only methods; it is organisation, and the common purpose inspiring and actuating the whole mechanism of production and supply that count.

* * * * * *

Official Seed Testing, 1922-23.

THE Annual Report of the Official Seed Testing Station will be published by the National Institute of Agricultural Botany in its Journal for 1923, which will be available early in the New Year. The following notes summarise the results during the season ending 31st July, 1923.

The number of samples received for testing was 21,678, which is a considerable reduction on the figures for 1921-22. The reduction occurs in the number of samples received from seed firms, there being little change in the number received from farmers. The decrease is particularly noticeable in the case of red clover seed, the samples of which were 50 per-cent. fewer than in the previous season. The main points of interest are as follows:—

Cereals.—Owing to the adverse harvest conditions in 1922 an increased number of samples showing low germination was received. This resulted in a decrease in the general average, which was especially marked in the case of oats, of which no less than 17.3 per cent. of samples germinated below 85 per cent., as compared with only 7.5 per cent. below that figure in 1921-22.

The number of samples showing indication of disease was, however, noticeably less. In the case of wheat 15.7 per cent. of the samples contained bunt, and 2.8 per cent. showed traces of earcockles, as compared with 33 per cent. and 9 per cent. respectively in 1921-22.

Pulse.—The germination of field beans and vetches has been considerably lower than usual. Vetches in particular were of poor quality, over 50 per cent. germinating below the minimum percentage scheduled in the Seeds Regulations.

Roots and Vegetables.—Owing to the unfavourable harvest conditions the germination of most of the root and vegetable seeds was somewhat below the average of recent seasons. Onion and carrot, however, show a slight, and parsnip a very considerable, increase in percentage germination over last season.

Clovers.—New Zealand seed shows the highest purity and germination It is unfortunate, however, that more attention is not paid to the removal of the small-seeded dodder from this seed. Alsike was of average quality, but mid-European samples produced better figures than usual.

Lucerne, trefoil and crimson clover showed figures very similar to the previous seasons. White clover, however, averaged rather higher germination, but lower in purity. Wild white clover contained a larger percentage of impurities than usual. Sainfoin showed a marked drop in both purity and germination.

Grasses.—Perennial ryegrass was of average quality, but Italian ryegrass was below the average. It is worthy of note that over 50 per cent. of the Italian ryegrass samples contained 1 per cent. or over of injurious weed seeds, whereas this figure has previously never exceeded 40 per cent. Cocksfoot was of rather better quality than usual, and particularly free from injurious weed seeds. The average purity of meadow fescue and dogstail also showed an appreciable increase. Timothy was of average quality. Other grasses call for little comment; they all show a high percentage of impurity, but this in all cases consisted almost entirely of chaff.

An account of the administration of the Seeds Act, 1920, during the year 1922-23 will be found at p. 822.

* * * * * *

Farmers and the Seeds Act, 1920.

SEEDS are perhaps more variable in quality than any other goods the farmer has to purchase. The *purity* of seeds varies according to the manner of growth of the seed crop and the methods of harvesting and cleaning it, and the *germination power* varies with the weather during the period of growth—especially at the time of harvesting—as well as with the method of harvesting and storing.

The Seeds Act, 1920, makes it compulsory in the case of a sale of any of the principal kinds of grass, clover, field or garden seeds, for the seller to state in writing certain essential particulars as to the quality—including the percentage purity, percentage germination, and the presence of injurious weed seeds.

Farmers, when buying their seed, should ensure that they receive this statement, to which they have a statutory right.

It is most important for farmers to note that in selling seed corn, or any of the scheduled kinds of seeds intended for sowing, such as red clover, tares, etc., they are in precisely the same position as a seedsman, and are bound to supply the same guarantee. Thus, a farmer selling a sack of home-grown clover seed to a neighbour for sowing must, in the first place, have a sample tested, and supply the buyer with a copy of the result not later than the date on which the seed is delivered. Any farmer can have the required test made at the Official Seed Testing Station, Huntingdon Road, Cambridge.

Further information as to the particulars required to be declared, and of the fees charged at the Official Seed Testing Station, are given in Circular No. 728/C.S., copies of which may be obtained free on application to The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

* * * * * *

The Rural Industries Intelligence Bureau and its Leaflets.

IN the June number of this *Journal* an article entitled "Village Life and Country Industries" was prefaced by a paragraph in which it was explained that the article was the first of a series on Rural Industries which was in course of preparation by the Rural Industries Intelligence Bureau. It was intended that all these articles should first appear in this *Journal*, but would be subsequently available in the form of reprints on application to the Bureau.

Since the issue of that number, which also contained a shorter article entitled "Hurdle Making by Machinery in North Wales," other articles on rural industries have been published herein. It has subsequently transpired, however, that the Bureau, in view of the large amount of information which is now reaching it on various subjects, has found it impossible and undesirable to attempt to compress these articles within such uniform limits as would make their inclusion in the *Journal* possible. For reasons of space, therefore, it has proved impracticable to include in the *Journal* certain articles on subjects which are not of general interest to the farming community. These articles have consequently been issued directly by the Bureau in printed form and uniform with the reprints of articles from this *Journal*.

The practice of including articles in the *Journal* nevertheless will continue to be followed as far as possible (*vide* "Mat Making" in the present number), but it may be desirable at this stage to furnish, for the benefit of interested readers, a list of leaflets issued up to date. In the following list, leaflets marked with an asterisk have already appeared in these pages:—

* Village Life and Country Industries (Leaflet No. 1).
* Hurdle Making by Machinery in North Wales.
* Straw Ropes and Straw Envelopes (Leaflet No. 2).
Peat Firelighters (Leaflet No. 3).
The Village Blacksmith and His Outlook (Leaflet No. 4).
* Walking Sticks (Leaflet No. 5).

Suggestions and Opportunities for the Rural Woodworker (Leaflet No. 6).
Handloom Weaving and Handspinning (Leaflet No. 7).
* Matmaking (Leaflet No. 8).
Compressed and Composition Firelighters (Leaflet No 9).

Copies of all the above can be obtained on application to the Rural Industries Intelligence Bureau, 258-262, Westminster Bridge Road, London, S.E.1.

* * * * * *

The Agricultural Index Number.

AFTER rising slowly for three months, the general index number of the prices of agricultural produce fell sharply in October, owing mainly to the much lower level at which hay of this season's crop is selling as compared with the prices of the 1922 crop. There was also a sharp fall in the index number for fruit, which is now based on apples only, whereas in September plums and pears, which were relatively very dear, were on the market. The general index number for October is 51 per cent. above pre-war, and is thus back at the same level as in June, and is 5 per cent. lower than a year ago.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	54
September	202	116	57	56
October	194	86	59	51
November	193	79	62	—
December	184	76	59	—

The average price of wheat remained unchanged at 8s. 11d. per cwt., but as there was a slight fall in October in the pre-war period, the index figure advanced by one point. Barley declined by 3d. per cwt. and oats by 1d. per cwt., against a rise of 2d. per cwt. between September and October, 1911-13, and the index number in each case declined by 5 points to 25 per cent. above pre-war. As compared with a year ago each cereal is cheaper by 3 to 6 per cent.

Most of the hay on the market during October was of this season's crop, and no doubt owing to the heavy yields this year, prices of new hay are much lower than those which have ruled for old hay. Clover hay is realising about 13 per cent.

more than in 1911-13, whilst meadow hay prices are at the pre-war level, hay being now relatively cheaper than any other class of agricultural produce.

Following the sharp fall in the latter half of September, potato prices have been fairly firm throughout October, and during the last two weeks a hardening tendency was in evidence. The index figure, however, shows a decline of 18 points on the month, the average price in October being 62 per cent. above pre-war, which compares with only 8 per cent. above in October, 1922.

The price of fat cattle has varied very little since the middle of August, and during October averaged 44 per cent. above 1911-13, or a little over 8 per cent. less than a year ago. Fat sheep prices have hardened during the last three weeks, and averaged 76 per cent. above pre-war in October, a rise of 4 points on the month. Fat pigs, on the other hand, which have been in large supply and affected by the decline in the price of bacon, have become cheaper, and declined by 7 points on the month to 48 per cent. above 1911-13. A year ago fat pigs were selling at 85 per cent. above pre-war prices.

As is usual in October the price of dairy cows advanced, but this year the rise was sharper than before the war, and the index figure rose from 52 per cent. to 61 per cent. above pre-war. The markets for store cattle have been disorganised in some districts by foot-and-mouth disease restrictions, but with the autumn demand increasing, prices have hardened somewhat. The rise has, however, been relatively the same as before the war, and the index figure remains unchanged at 27 per cent. above 1911-13. Store sheep were also dearer in October, but the rise was not so great as usual, and the index number shows a fall of 10 points to 99 per cent. above pre-war. Prices of store pigs have declined in sympathy with those of fat pigs and were 82 per cent. above 1911-13 in October against 95 per cent. above in September. It may be mentioned that the index figures of dairy cattle and store stock are not taken into account in calculating the general index number for all classes of agricultural produce, as store stock when sold simply pass from one farmer to another.

Winter milk prices came into effect at the beginning of October, and the average contract price in October was 72 per cent. above pre-war; a year ago the increase was 90 per cent. In the case of both butter and cheese the rise in price in October was sharper than usual, and the index figure for butter advanced by 5 points and for cheese by 2 points on the month. Cheese is 30 per cent. dearer than in October, 1922, but butter is 6 per cent. cheaper. Eggs are now very dear, and during October averaged 92 per cent. above pre-war, but were 6 per cent. cheaper than a year earlier.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	Oct.	June	July	August	Sept.	Oct.
Wheat	24	38	39	29	19	20
Barley	29	17	12	9	30	25
Oats	33	41	41	30	30	25
Fat cattle	49	52	45	46	45	44
Fat sheep	90	83	72	76	72	76
Fat pigs	85	69	54	52	55	48
Dairy cows	69	50	49	51	52	61
Store cattle	30	31	28	28	27	27
Store sheep	106	114	109	101	109	99
Store pigs	135	130	113	102	95	82
Eggs	104	40	36	68	75	92
Poultry	77	87	79	61	67	65
Milk	90	53	57	67	67	72
Butter	71	33	37	48	56	61
Cheese	36	44	54	67	74	76
Potatoes	3	—31*	66	80	75	62
Hay	45	42	38	34	32	7

* Decrease.

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Conciliation Committees in Agriculture.

THE agreement of the Cheshire Committee, which was due to expire on 31st October last, has been extended up to 30th April, 1924. The terms provide for payment to adult male workers at the rate of 32s for a 54-hour week, with overtime at 9d. per hour.

The Lancashire Committee has decided to extend the period of operation of its last agreement from 31st October last to the end of January, 1924. The weekly rates of wages for adult male workers for the normal working hours are as follows:—Southern Area: special classes, 35s., other workers 32s. 6d.; Northern Area: special classes 37s. 6d., other workers, 35s.; Eastern Area: special classes 40s.

The Committee for Shropshire has also agreed to maintain wages at their present level, the agreement due to expire at the end of October last having been extended up to 1st March, 1924. The rates are 30s. for a guaranteed week of 54 hours for able-bodied adult male workers, and 9d. per hour for Sunday work.

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THE BACON PIG.

There is in this country a large demand for bacon of the best quality—a demand which is at present inadequately satisfied by the British producer. There has been a considerable expansion in pig-breeding since the War, but the output as yet does not even meet the demand for fresh pork, still less for pigs to be converted into bacon. The rearing of pigs offers one of the most remunerative opportunities open to the British farmer, and is still capable of great expansion, especially in view of the low prices ruling for cereals and other farm crops upon which the pig may be fed

It is not the purpose of this article to discuss the various alternative methods of pig-keeping that may be adopted or the relative advantages of pork and bacon production. These must be determined by the conditions of the farm and the local market. The farmer who sets out to produce bacon pigs should breed and feed with the object of turning out a uniform product of the type that can be converted into first quality bacon with the least amount of waste. It may be emphasised that a pig suitably bred for the bacon manufacturer is usually an excellent pork pig: but it does not follow that a pig which may be killed for pork is of suitable structure for first quality bacon.

Strong representations have been made to the Ministry by the bacon curers that they are unable to obtain sufficient pigs of the right quality to enable them to keep their businesses running at full power, and that in particular they receive an undue proportion of pigs which cannot be converted into first quality bacon. It is stated that in other countries, notably Denmark and Sweden, where pig rearing has been organised for the production of bacon, as many as 75 per cent. of the pigs sent to market are convertible into first-class bacon, largely as a result of aiming at a standard type, whereas in England. doubtless partly owing to the numerous breeds and crosses, the proportion is no higher than 25 per cent. A large proportion of the pigs in the remaining 75 per cent., although of good quality, are too fat and heavy for first-class bacon.

In some respects the responsibility for this undesirable state of things rests with some of the bacon curers who have paid upon a basis of weight alone without reference to the suitability of the carcass for bacon production, but the Ministry is aware that certain firms of bacon curers have now become selective in buying and are adopting an improved method of payment.

The Ministry considers that the development of the bacon industry and the production of the right type of bacon pig will depend upon the financial inducement offered to the farmer by the bacon curer for the supply of graded pigs at recognised graded prices. The farmer, too, should realise that by helping forward the bacon industry he is stabilising prices for himself. The producer, the curer and the retailer are all equally interested in the industry, and equally responsible for increasing and improving the supply of English bacon. They are, in fact, partners, and the interest of each is bound up with that of the others, and close co-operation between them is essential.

The Bacon Pig.—The ideal bacon pig should conform to the following standard:—

1. *Back.*—Long and level, with ribs well sprung.
2. *Sides*—Level and moderately deep.
3. *Hams.*—Broad, wide and deep to hock. Tail set high.
4. *Belly and Flank.*—Thick with straight underline.
5. *Shoulders.*—Light, and on a line with forelegs below and with sides laterally. Free from wrinkles and coarseness.
6. *Flank.*—Aligned with the sides.
7. *Head, Neck and Jowl.*—Light.
8. *Legs.*—Short, and set wide apart. The pig should stand well up on the tips of the toes.
9. *Bone.*—Fine.
10. *Flesh.*—Firm, without excessive fat.
11. *Skin.*—Free from coarseness and wrinkles.
12. *Hair*—Fine.

There should be no rolls of coarse fat at the jowl or over the neck, and no depression between the hams at the root of the tail, as this indicates excessive fat. The pig should be full and firm behind the elbow, and the flank, which should be thick, should handle firm. The streak cannot be too thick so long as there is a proper proportion of lean to fat. The fat part of the back should never exceed 2½ in. in thickness, and may be as little as 1½ in. in thickness. Fineness of bone is of great importance.

The size calculated to produce the best price is the medium bacon pig producing sides when cured of 56-65 lb. in weight, *i.e.*, a pig approximately 220 lb. live weight or 160-165 lb. dead weight. Such pigs should be ready at about seven months old. Heavier pigs, up to 260 lb. live weight, find an outlet in the Midlands and the North, and many are absorbed by the ham and cutting trade, the loin being sold for pork and the hams and bellies cured for bacon. Animals over 260 lb. live weight are not likely to sell at higher prices than fat sows. The farmer should acquaint himself with the weight desired by the bacon curer with whom he deals.

Breeds and Breeding.—The ideal bacon pig can be raised in many ways from the various English breeds. It is generally agreed that the bacon type of pig can best be obtained as a first cross, using one of the large breeds to attain length of side. It is rarely wise to go beyond the first cross, as with a second cross the progeny often fail in uniformity of type. As an example of a suitable cross, many rearers of bacon pigs use Large White boars for their length of side, with a Middle White sow to secure more rapid growth and a better ham and streak. A cross the other way about also makes a very good bacon pig. The bacon pig can, however, be obtained from other breeds and crosses provided that the breeder keeps in mind the type outlined above. Owing, however, to the presence of black pigment in the mammary glands of certain races of black pigs, producing the so-called "seedy cut" in the streaky, wholly black pigs should be avoided, unless, as seems possible, strains can be selected which do not show "seedy cut." The progeny, however, of crosses when one parent is pure white rarely show "seedy cut"; for example, Large Black sows crossed with a Middle White boar, or Large White over Berkshire yield pigs which are mostly white or blue and white and are less likely to show "seedy cut."

Feeding.—The feeding of pigs for bacon is not dealt with fully here. It will be sufficient to emphasise the fact that bacon pigs should not be too fat but should show a good proportion of lean, and that foods tending to produce soft fat should be avoided. An excess of swill or too much maize or linseed tends to produce an undesirable quality of fat. The use of fish meal is risky. Fish meal should only be employed when the farmer can make certain (1) that he obtains the right kind of white fish meal; (2) that the man in charge of the pigs will only feed to each pig the strictly limited amount which can safely be fed without tainting the flesh. Even this limited use of fish meal is undesirable after the pigs reach about 100 lb. live weight, but in any circumstances the use of fish meal should be discontinued four weeks before the pigs are sold for slaughter. The use of the wrong kind or of an excessive quantity of fish meal, or fish meal used too close to the killing time results in a taint in the flesh of the pig which renders it absolutely unfit for bacon. Cod liver oil is perhaps even more dangerous.

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PIG-KEEPING.

IV.

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Selection, Feeding and Management of Breeding Stock; Open air Pig-Keeping on Grass and Forage Crops; Supplementary Rations; Methods Employed in Folding.

Selection of Breeding Stock.—In purchasing their foundation stock, there are several courses open to those starting pig-keeping. Pigs can be bought in the ordinary market, or at pedigree pig sales, or privately. The first method is least to be recommended, because the buyer is usually unable to learn enough about the pigs' ancestry. He does not know whether they may or may not have been in contact with disease. He may not even know the farm from which they have come, and it is important that he should have information on these points. For those reasons private purchase from reliable sources is perhaps most satisfactory.

At pedigree stock sales, pigs are often offered in very fat condition. Superfluous fat fills up many hollows and smooths down many humps, and with an outside covering of fat, pigs can be made to look attractive to would-be purchasers. Certain buyers are impressed by the size and apparent substance of fat heavy animals and good prices have been obtained for them. In addition to obscuring faults, superfluous fat has other disadvantages. If deposited in excess in the reproductive organs, it may seriously impair the breeding capacity. If deposited in the udders of females, it may interfere with milk production. If a sow farrows in this over-fat condition she is much more likely to be lazy and clumsy and to lie on her pigs. The practice of offering very fat pigs at sales of breeding stock should be discouraged.

A clever judge can recognise a good pig even when it is in "the rough" or in ordinary breeding condition; a poor-judge can only appreciate an animal when it is fat. The services of the former may be very helpful to a beginner in choosing his foundation stock. It should be clearly understood that there is a difference between "fatness" and "fitness." A well-bred pig which has been suitably fed and managed will have that "fit," attractive appearance which is secured by an even covering of firm flesh and by that nice "bloom" of coat and skin which is associated with good health and vigorous and sound digestion.

Animals intended for breeding should be selected from uniform good sized litters. The dams should be good milkers, and healthy, good tempered and careful mothers, active foragers and typical of the breed to which they belong.

If possible, the purchaser of breeding pigs should see their sire in order to learn whether he is a good specimen of his breed. He should also see as many of his litters as possible, to enable him to form an opinion as to his breeding capabilities. The progeny of a coarse, strong-boned, rough boar should be avoided, as it is possible they may be deficient in quality and lack early maturity.

Gilts selected for breeding should have not fewer than twelve teats, and they should have a reasonable standard of weight for age, taking into consideration the amount and nature of the food which they have been receiving. If possible, gilts of sixteen weeks old or upwards should be selected, because with younger animals it is more difficult to form a reliable idea as to how they are likely to develop. In-pig gilts are usually a good investment as they are near profit. and yet have the whole of their productive lives in front of them.

At sales the older sows are sometimes well worth the money they realise. and if one can find out beforehand what sort of breeders they have been, and if their udders are still sound, they may prove an economical purchase. On the Moulton Experimental Farm an old sow born in 1916 reared litters up to 1923, and another born in 1918 has reared twenty-seven pigs in her last three litters. It is a common opinion that sows should be discarded for breeding after their fourth litter, but provided the sow is breeding well, it would seem advisable to breed from her as long as she will produce profitable litters.

It cannot be too strongly emphasised that in selecting foundation stock, the buyer should keep in mind the importance of breeding uniform pigs. The females should therefore not only belong to the same pedigree breed, but they should be in themselves as uniform as possible. Further, pedigree pigs will produce thriftier offspring than mongrels. There is everything in favour, therefore, of keeping pedigree breeding stock whether one is to produce pure breds or first crosses.

In selecting a boar one should try to get an animal conforming as nearly as possible to the standards already laid down, but, in addition, he should be of a type likely to correct in his offspring the prevailing faults of the sows. An active boar that champs and foams at the mouth when brought near another boar, and which exhibits signs of keen sexual excitement when near a sow which is in season, is likely to prove a sure stock getter. An animal which does not readily show sexual excitement may prove slow at service or may refuse to serve altogether. A savage boar is undesirable, both because he is difficult to handle and because he may breed restless and troublesome pigs. A boar should be fit for service at 8 to 10 months old.

The correct age at which gilts should be mated is a matter on which there is some difference of opinion, but on the average a gilt should be fit to serve at about ten months old. If served at eight months, which is a usual age, she is apt to remain undersized and will have difficulty in rearing sufficiently well a fair-sized first litter. If, on the other hand, she is not mated till one year old, which is the common practice in many of the pedigree herds, she may become overfat, and there is then greater difficulty in getting her to settle to the boar. In addition, at the times when she is in season before service, and more particularly after she has attained the age of ten months, she is usually very restless and excited. The body temperature is temporarily raised, and after she goes off season there appears to be a general lowering of vitality, with the result that she is then more liable to contract a chill or other illnesses.

With regard to the feeding and management of breeding stock, the main point of importance is to keep them in healthy, active, fit condition without allowing them to become too fat. Plenty of exercise, attention to the provision of a fairly easily digested ration with a sufficiently narrow albuminoid ratio,* and an adequate and regular allowance of green food or roots, should go far to secure the desired condition. At about a fortnight before the sow is due to farrow, she should be put in the sty or hut where the litter is to be born. She requires some little time to become used to new quarters—many unsuccessful farrowings are due to putting the sow in fresh and unfamiliar surroundings too near the time of farrowing.

From the time a sow is put in her farrowing pen she should be fed on about 4 lb. per day of a special ration suitable for farrowing and suckling sows—that is to say, a slightly laxative ration with a narrow albuminoid ratio, and preferably containing 10 per cent. of bran. The percentage of barley or maize meal should not exceed 25 per cent., and an effort should be made to secure for her a daily supply of fresh green stuff. The farrowing pen or hut should be about 9 ft. square, and a farrowing rail 9 in. from the ground and 9 in. from the wall is useful in preventing the sow from lying on her pigs. Short chaffed straw is recommended for bedding, as the little pigs are less liable to get entangled in it than in long straw, and are thus less likely to be smothered.

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* This *Journal*, October, 1923, p. 630.

A sow that has been treated in this way should farrow without difficulty, and cases where interference or assistance is necessary on the part of the herdsman are found to be extremely rare. The herdsman should be discouraged from interfering with the sow, and it is only when it has become clear that there is some abnormal condition, that any interference is justifiable, and this should only be carried out after the most careful disinfecting of the hands and arms in a sufficiently strong antiseptic. Before the hand is inserted in the vagina or passage, it should be smeared with carbolised vaseline. The cleanse or placental membranes should be removed from the sty to prevent the sow eating them. After a prolonged or difficult farrowing the sow might be given her first meal warmed to the temperature of the body. Warm milk answers excellently.

For the first few days after the birth of the litter, care should be taken that the sow is not overfed. Overfeeding or the employment of a ration which is not sufficiently digestible will interfere with milk production, or in serious cases induce that abnormal condition of fever which results in the sow eating or destroying her pigs. After careful investigation of this matter of sows' "savaging" their pigs, the writer can say that he has found this to be very rare where proper care and attention is given to the feeding and management of the farrowing sow.

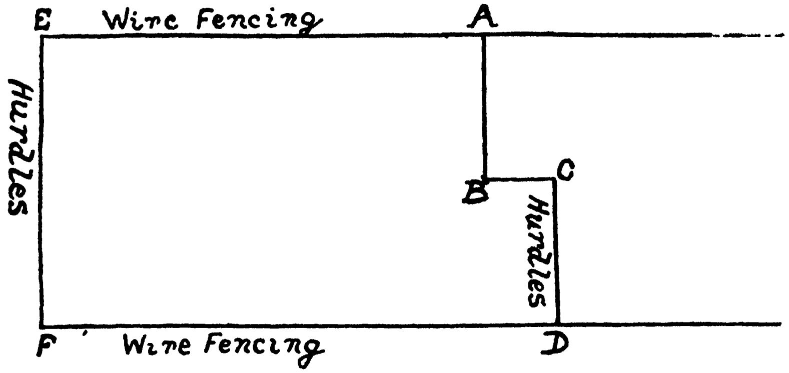
When two litters are to be obtained annually, possibly the most suitable months for the litters to be born are January to March, and July to September. In herds where contracts are made to supply regular numbers of pigs to butchers or bacon factories, it may be found necessary to have sows farrowing all through the year, but wherever possible November and December should be avoided. The most suitable age for weaning pigs is 10 weeks—this allows the little pigs a very fair chance, and if the sow is served the first time she comes in season, which will be about the fourth day after the pigs are weaned, it will enable litters to be obtained at intervals of approximately six months.

The satisfactory rearing of little pigs is the most difficult part of pig-keeping, and on it depends to a great extent the success of the whole pig-keeping enterprise. The aim should be to keep the little pigs going on without check or disorder. If the sow has farrowed in an open hut with a run attached, the little pigs will soon venture out into the sun and exercise themselves. Exercise and fresh air aid digestion and sharpen the appetite, and when the sow is confined to a sty she should be allowed to go out of doors with her pigs as early as possible after farrowing, allowing for weather conditions. As soon as the little pigs will eat they should be fed apart from the sow with a ration which is specially adapted for them. With a little ingenuity, means can usually be devised for feeding the little pigs separate from the dam. In a yard or out of doors, the trough or feeder can be placed in a small enclosure made with four posts and rails so that the little pigs can get to the trough without the sow being able to steal their food. Unless the little pigs are on grass or arable crops they need green stuff or roots at the earliest age they will eat such food. When young pigs are fed in this way on dry food, and care is taken to provide them with sufficient liquid either in the form of water or separated milk, they seem to do better on dry than on wet feeding.

Open Air Pig-Keeping.—The fundamental principle of open air pig-keeping is that pigs are not confined to sties all the year round but are allowed out to graze either on grass, or arable land or in woodlands. Usually a hut or cheap shelter is provided. Open air pig-keeping was not common before 1914, but it had been practised in a few herds for some years previous to that date. The possibility of its successful application to commercial pig-keeping has now been generally recognised, and it has become the established practice in most commercial pig breeding enterprises.

When carried on in woodlands as is frequently recommended, there must be very considerable loss of valuable manure unless the woodland is made use of afterwards for some special purpose for which the residual value of the manure can be fully utilised. The possibilities of such use are not very great, and it would seem desirable that on a mixed farm pigs should as far as possible be kept on arable land. In the case of very poor grassland, however, pig grazing in conjunction with the judicious application of artificial manures, notably basic slag and lime, has brought about marked improvement.

There is an absence of exact information on the economic side of arable land pig-keeping. On the technical side it has been demonstrated that a suitable succession of crops can be grown, and the pigs managed successfully while folded on them. Arable land pig-keeping has been carried on with success by Messrs. Wilkin & Sons, at Tiptree for some years,* and it is now being practised to a considerable extent throughout the country. Generally speaking, the same crops and conditions which are found suitable for the folding of sheep will be suitable for the folding of pigs. Pigs show a preference, however, for vetch mixtures, clover, lucerne and rape. They do not appear to care for turnips as grown in the Midland counties, but they like swedes. Helpful suggestions as to suitable successions of crops have been made from time to time by Stanley Wilkin in his publications,† and also by J. C. Brown in Harper Adams College Reports. A farmer should have no great difficulty in working out a succession to suit the circumstances of his particular farm, but where the results of local experience and experiments are wanted for guidance he should apply to the Agricultural Organiser for his county for information.



Mr. Wilkin states that a sow will eat 16 lb. of kale per day, a six months old pig 10 lb., and a four months old pig 8 lb. Our investigations with regard to green and root crops generally, would tend to show that, making an allowance for trampling, rather higher quantities will be accounted for, say, 20 lb. in the case of the sow and 12 to 14 lb. in that of the six months old pig. The table given on p. 711 of this *Journal*, November, 1923, will show the rate at which these quantities of forage crops will replace mixed meal in feeding. Taking the above figures and the average or estimated yields of different crops, a simple calculation will show the acreage required for a given number of pigs. If we take an average crop of thousand-headed kale as 16 tons per acre, 14 sows each consuming and trampling 20 lb. per day would use 2½ cwt. daily, or 1 ton in 8 days. One-quarter of an acre of kale would therefore supply green food for the above number of sows for 32 days. In-pig sows eating this quantity of green stuff would need in addition about 2 to 3 lb. of mixed meal per head per day according to their condition.

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* See this *Journal*, August, 1920, pp. 456, 457.

† Stanley Wilkin's Annual, 1923-4, 1/- post free.

The fencing of pigs on arable land may present some difficulty. Iron hurdles on wheels are satisfactory but they are expensive, and it is suggested that the fold be laid out with two parallel rows of pig wire fencing, and wooden or wattle hurdles used crosswise (see diagram on p. 796). To give a fresh supply, the hurdles A, B, are moved forward to give a straight line with C, D. Next day the hurdles C, D, are moved forward and the hurdles C, B, again inserted, and so on.

Shelters on runners which can be moved by yoking a horse to them are found most convenient for folding where frequent changes are necessary. To secure the uniform distribution of manure, it is essential that the huts and feeding troughs should be moved at frequent and regular intervals, preferably daily.

We do not favour the keeping of pigs in small enclosures with permanent grass runs. These grass runs are apt to become very foul and muddy in winter or during a prolonged period of wet weather, especially near the huts and feeding troughs. It has been found that foul runs may become infested with worms which are parasitic in the pig. Further, in summer it may be difficult to keep the grass closely enough grazed. It is better wherever practicable to give pigs a considerable range on grassland and if due consideration is to be given to the improvement of the herbage, grazing with other classes of stock will be advisable at intervals. It is most important that the grass should be cropped down bare at least once a year. Grazing with stock other than pigs, or mowing, may be employed to secure this end.

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THE TEACHING OF AGRICULTURE.

SIR A. DANIEL HALL, K.C.B., LL.D., F.R.S.,
Chief Scientific Adviser and Director-General of the Intelligence Department of the Ministry of Agriculture.

The substance of an address given by Sir Daniel Hall to the Agricultural Education Association at Aberystwyth on 10th July, 1923.

I CANNOT help feeling that the object of my remarks is still somewhat in a tentative condition, and it may be better if I reserve a formal exposition of the subject so that all I have to say may be regarded by way of stimulus and suggestion rather than a direction to a particular action that I should like to see taken. This must be the case with all good teaching. The teacher has to work out a method, that method may not be a good one for universal adoption, but if a man has worked it out for himself and is keen, the very fact of his keenness may make that method an extremely profitable one.

Closer Consideration of the Method of Teaching.—What I have to bring before you is this, put broadly, that the actual method of our teaching, whether we teach inside the college or the farm institute or whether we teach in the county, requires more consideration than it ordinarily gets. We all of us in this country begin teaching agriculture in a thoroughly haphazard amateurish fashion. We go to college and later on when we leave, we find ourselves put in front of a class and required to teach on our own account. I think most people's experience would be similar to mine; no one gave me a hint or suggestion of what methods to follow—I floundered about and tried one method after another.

Many scientific and technical men have a certain scorn for what generally may be called the art of exposition, whether in speech or writing. In writing I have often occasion to deplore the style and quality of the written matter that is put out. In teaching I have from time to time listened to lectures and classroom instruction, and I do think the teaching might be enormously improved if the men thought a little more about this matter of teaching as an art in itself, independent of the material that is to be set forth, an art which has a code of rules and laws of its own. I do not want to lay down methods at this moment. Every man will think out his own method, but I do want to plead for a consideration of the method itself as something worth thinking about, something by which the work—whether it is in classroom or lecture room—can be made more effective. I want you to take it that teaching is not a process into which you drop quite naturally, that it only involves the doling out of so much information to be got up by the class. whereby all the teacher can be expected to do will have been accomplished. If that were the case, if there were nothing in the functions of the teacher but to hand out a certain amount of knowledge, why have any oral teaching at all? Why not content oneself .with books, or with some kind of organisation like the correspondence college? The organisation of a correspondence college for example can show the student exactly what he ought to read, it can set him papers, mark and comment on them. The way these colleges flourish proves that they can be effective in promoting the acquisition of knowledge for examination purposes. In fact one must take it that the very existence of these correspondence colleges on a large scale points out that there is a defect in the ordinary teaching given in the country. If the oral teaching were of the right kind the correspondence college, which gets its results and could not live if it did not get its results, would go out of existence.

To give an illustration of what I mean: you are all familiar with one of the very commonest forms of classroom teaching in University or University College—the lecturer who practically dictates to his students a certain text which he has prepared. The lecturer prepares very carefully his lecture as a résumé of a particular section of the subject and delivers this from the platform so that every student may take it down verbatim and get it accurately transcribed into a notebook. That form of instruction is very popular, especially amongst students. It supplies them with a short cut to knowledge; it absolves them from the necessity of reading anything other than their notes. They need not buy text-books; still less need they compare the different views of other people on the subject, and they regard this as a very profitable form of instruction. If they get up the notes which the professor has given them they expect to be able to pass the required examination. One knows the type of lecture notebook which is produced in that way, and I believe in some of the Universities it has considerable financial value. That always reminds me of a story of a Cambridge undergraduate in the time of a very famous coach known as Big Smith. The undergraduate had just come into residence and was taking counsel with some senior friends as to what course to pursue, should he read for Honours or a Pass. He asked what was the difference between a Tripos and a Poll degree. The old hand replied "if you go for the Tripos you go to Brown, of Trinity, and he tells you what he thinks about it; then you go to Jones, of Jesus, and he tells you what he thinks about it; then you go to Tomkinson, of Caius, and he tells you what some other Johnny thinks. If you take a Poll you go to Big Smith and he tells you what it *is*." That is the attitude of the typical undergraduate; he wants positive knowledge delivered to him in neat little packets ready to be handed over the examination counter. I submit, however, that the teaching of that kind will eventually be replaced by the gramophone. It would be cheaper to the University to replace such professors by gramophones.

Of course there is the converse of the process, where the lecturer refuses to allow his students to take a note at all. That was my own practice in the later days of my actual teaching career. I was asking my students for their attention; I did not want them to divert their attention by taking notes. The object of my lecture was to impart a point of view and to get my students to apprehend the principles of the subject. So far as notes went it was my practice to issue a typescript at the end of the lecture, which contained subject headings, tables and diagrams, and references to the text-books indicating where details of the matters dealt with could be found. I do not say mine was the right way but it was an attempt to teach, whereas the other way is only an attempt to supply information. I throw out that as an illustration; the point I want to make is that the mere process of teaching does require thinking about.

On the other side let us take the outside lecture, the lecture that every college or institute teacher is required to give from time to time to audiences in villages and country centres. As a rule the preliminaries are organised for him; he walks into the place and is rather apt to suppose that if he delivers the lecture and the people do not leave the room in too large quantities during the process, that his method is good. If the audience falls off during the lecture course, he blames the organisation

But we have to ask ourselves whether the lecture method is suited to the village audiences at all, whether the type of teaching we have to do in the counties has not got to start from an entirely different point of view. I want to suggest that the prime effort of the extra-mural teacher must be in some way to drag the members of the audience into the fray themselves. They must be led to become active participators in the process of education. You have not much time in dealing with an audience of that description; you are running over the whole of agriculture, perhaps in six lectures and you only have time for stimulus. The technique of the process by which you can get your pupils to read and work for themselves does require a good deal of consideration. Put yourself the question, "How am I to get my audiences to help themselves? I, in charge, can only help people, I cannot teach them; I can only point out the lines upon which they can teach themselves."

How we can Improve our Methods of Teaching.—I take these as illustrations of the kind of subject I should like to see discussed, the methods of teaching inside and outside the college, how, by thinking for ourselves, we can improve our own methods. I want specifically to suggest the question of how the subject of agriculture itself ought to be treated in our Colleges and Farm Institutes, etc., because there I can see perhaps the greatest opening for better technique and indeed for some considerable reconstruction of our aims in teaching agriculture.

I think we are inheritors in this country of rather a mistaken tradition. I know quite well 30 years ago when colleges began to start in Great Britain for the teaching of agriculture, the general idea of their founders was that agriculture could be regarded as an assembly of applied sciences. There was chemistry, botany, zoology, geology and so forth, all sciences throwing light upon the growing of crops and the feeding of animals. If we first taught these sciences to agricultural students and then the application of those sciences to agriculture, we were teaching agriculture. You may remember that the first Cambridge diploma did not proceed further than that. It was content with an examination in applied sciences and treated agriculture itself as one of those rather mechanical extras which are pursued in practical life but which should hardly concern the university. So I think we were given a set towards the treatment of agriculture as just an assembly of applied sciences, and it was conceived that we could bring out a farmer by grounding the youth thoroughly in chemistry, botany, zoology and so forth.

Now agriculture is a subject *sui generis*, something quite distinct from an applied science; it has its own technique and methods and its own fundamental science, which is neither chemistry, botany nor zoology, nor anything of the kind popularly termed science. It is accountancy which lies at the basis of the teaching of agriculture, and as pure chemistry is the grammar of the agricultural chemist and botany of the agricultural botanist so is accountancy the grammar fundamental in the instruction of the farmer.

The Object of our Teaching.—If we start off with that somewhat one-sided statement we shall get a little nearer to what is the right form of teaching. Let us begin by asking ourselves what we are after when we are dealing with the young men in an agricultural college. What is our object; what are we going to try and turn out? I think it is agreed that we are not thinking of turning out teachers, officials or that kind of man; we are thinking really of turning out a thoroughly equipped farmer and we want to ask ourselves what we mean by that—a thoroughly equipped farmer under modern conditions, and how we can help to ensure that type of man by education. We know well the old farmer who has no education behind him; he tells the teacher that no-one can learn farming in a classroom and that he has no opinion whatever of book farmers. The answer is not easy, but I think we can remove that kind of reproach if we take our teaching of agriculture from a somewhat different angle. What he means is that success in farming depends upon a number of qualities which are personal and many of which are only obtained by experience. If a man has no will or determination, if he lacks a certain firmness about making a bargain, of course he cannot become a successful farmer—and none of the efforts of the educator are directed towards 'giving these qualities.

Still, putting aside these inborn faculties and the essential matter of experience, what does characterise a good farmer as distinct from a bad farmer? We can sum it up in one word —management. The good farmer not only knows what work has to be done, what good wook is, the technique of growing his crops and breeding cattle, etc., but he knows how most effectively to dispose of the staff of labour that he has on that particular land. His job as farmer is a manager. The agricultural college is dealing mainly with men who are going to be managers of labour, directors of other people's work. They are not going to do manual work themselves, except perhaps in their younger days, but in the main they are going to be heads and not hands.

Developing the Idea of Management.—When you turn to compare the successful with the unsuccessful farmer you will probably find in a great many cases that the question of financial success depends upon this disposal of labour more than anything else. We may sum up the object of the agricultural college as the training of managers. That being the case what I want to submit to you is that we must direct our teaching to that end.

Suppose we turn to one of the most successful text-books on agriculture that we have in England, the late Professor Fream's—almost the only widely distributed text-book that has been written in English on agriculture—do you find that point of view, management, set out from the beginning of the book to the end? There may be an odd chapter or two about it, but in the main the book is concerned with the description of the materials of the farmer. You are told how to discriminate between fescues and poas, hop trefoil and yellow clover—just the kind of things that are so much taught and learned by the agricultural student and so heartily despised by the old type of farmer. The old farmer is wrong; you cannot know too much of anything. None of these descriptive points are without their value, only they cannot replace the other things, the vital study of the economics of a farm and its management. That is the point that I want to bring forward in these remarks.

The teaching of agriculture as I have seen it, and I speak from experience, is far too much a mere matter of description. It may not even be descriptive of the kind of farm the teacher knows himself, it may be a discussion on the old systems of farming. It is not unknown that men continue to teach the East of Scotland form of agriculture as described in Stephens' "Book of the Farm" as the only method of successful farming. It may have had little to do with the farming that was going on round about the college, having been worked out on a different rotation and for a different soil and climate. Let us have done with this purely descriptive teaching of agriculture.

The teaching of agriculture should be to an increasing degree a matter of personal experience, and it should be in every district largely based upon what is going on round about the college. It should begin as a description, so far as it is descriptive, of the farming practice amongst the people the student comes from; that is the first thing; let us localise our teaching. In this way the teacher can introduce the element of personal investigation; he begins by finding out what the people round about are doing, that will lead him to comparisons of their methods with other people's methods. He can fall back on the standard system of his text-book, compare it with the local system and discuss the difference that he finds between the two. The critical faculty is brought into play.

But we must go a step further if we have in view management, so that the student, when he leaves college and begins to work on his own account, shall be in a position to be critical of the work that he gets done, and not merely in the hands of his foreman or bailiff. We must not be content merely with describing. We must ask ourselves about each of the processes, how many men, how many horses, how much time, what will it cost step by step, and criticise these costs in the light of the results. Here the real critical process comes into play. The agricultural teacher dealing with, say, the potato crop, should have acquired for himself, by direct observation, a picture of the practice of a successful potato grower under certain conditions. He has followed the crop through, he has found out the number of men at work and the amount they did, and he is in a position to sum up the costs. That alone is a description which may be a great help to a student later on. But if he can set alongside that a description of the methods of two other equally good farmers and in different districts with the details of the alternative operations, the number of men on the job and the costs, I should think he is entering his students in the art of being managers. That is the first step. It has not got to end there.

After the teacher has been through the raising of crops and the treatment of livestock as individual operations, he has got to get his students into a perception of how a really good farmer schemes out his work from week to week, and how, given a certain staff at his disposal, he uses them to the best advantage. From my own observation of practical farming there lies the difference between the successful and the bad farmer—the way in which a good farmer has his work planned out and with a given staff always is ready to throw in his strength at the right moment. Of course you cannot teach that, but you can awaken the student very much to the necessity of thinking it out for himself.

It is in that connection the college farm is going to be most useful for the purpose of the teacher. The college farm should be run as a practical business proposition which is illustrating management and which is a text-book of the teacher in the lessons he is giving. Every student should keep an exact diary week by week of the operations that go on on the college farm, and it should be a diary with full details. It does not record "March 15th. sowing barley on the 10-acre field." No, he says "sowing barley on the 10-acre field; wheat stubble ploughed in November, wanted more frosts, a little stale on top and wet below." Then should follow the operations, the horses and men to each and the time taken. Further, the teacher should be giving the actual cash transactions from week to week. The teacher taking his class on Monday morning will say "our business during this week is so and so, I propose the men shall do so and so," and he shows them how he has schemed out the use of his staff during the week and the alternative in case the weather is unfavourable. It is in this way we can make our agriculture itself scientific, and not merely descriptive of accessory scientific facts which may be of value but which are of secondary importance compared with the question of management.

When we get on to the second and third year of teaching we have to consider broader economic questions; the reason for this or that branch of the business, why we are producing milk, why we are fattening bullocks, etc. We can begin with a consideration of the policy of the college farm, for it is the one which is close at hand, the one about which the teacher has the most details. But neighbouring farmers are generally willing to help the college by disclosing enough of their accounts to give the teacher materials for the discussion of policy. Now this means that agricultural teaching should be founded upon a system of cost accounting. The future of efficient management depends fundamentally upon a good book-keeping system to begin with, and the constant use of that book-keeping to check operating costs, so I think that the student must be inducted early into the point of view of cost accounting.

We are apt sometimes to assume that we can describe the right method of farming. I do not think there is a right method of farming, there is only a best compromise to adopt under given circumstances as regards soil, climate, markets, etc. The teacher's object should be to get the student into a critical way of examining other people's work so that eventually he will pass on to criticise his own work. The machinery for this is only to be supplied by a sound system of costing. Therefore the teacher of agriculture should investigate costs for himself so as to establish a comparative system of teaching, comparing

A's methods with B's methods and discussing with his class how relatively they arrive at the same ends though one may cost a little more. He is then in a position to criticise the whole conduct of particular farms, always with the management in view, and the results in cash as the fundamental test of the rightness or otherwise of the operation.

I do not think I need say anything more. I could have elaborated, but I rather want to throw out these suggestions for you to turn over for yourselves and see if they will not strike on your box and modify the methods by which you teach. I am convinced that if you think about these points of the technique of teaching, you can make your work more effective.

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THE AGRICULTURAL SITUATION IN THE UNITED STATES.

THE rapid fall in prices, particularly of agricultural products, that has taken place since the War, has been experienced with at least as great severity in the United States as in Europe. So seriously have the depreciated values of its produce, as compared with the costs of growing it, affected the farming industry, that the United States Government last spring called a conference of economists and others to examine the situation. Four Committees were appointed to deal more especially with the prospects of foreign demand for American farm products, the prospects of the home demand, the position of the hog industry, and wheat growing. These Committees submitted reports, and a second conference in July last approved these reports and drew up a general summary of the situation. The following notes represent the conclusions of the conference: the data given in the reports have been reproduced, but more recent estimates issued by various Governments are given in brackets, so as to bring the information down to the latest date.

Wheat Situation of the World.—A current crop for the Northern Hemisphere moderately larger than that in 1922 is indicated. The Committee report that this increase represents only a small percentage, adding the caution that it might be entirely wiped out, or on the other hand augmented, by later developments in North American spring wheat or in the crops to be harvested early in the New Year in Australia and Argentina. (This caution was justified, for later reports regarding the crop in Canada point to a harvest considerably greater than was then anticipated.)

In the United States this year's production of wheat was in July forecast at 440 million cwt. (the October estimate puts it at 419 million), as compared with 462 in 1922, and a pre-war average of 370 during 1909-13. The Canadian crop was regarded as probably being in the neighbourhood of that of last year (latest indications make it 37 million cwt. greater), when it was 214 million cwt., the pre-war average being 106 million.

In Europe, judging by those countries for which data were available, it was expected that there would be an increased production of 63 million cwt.; while North Africa would yield 13 million more; in India and Japan there was an increase of 18 million. (The latest data point to an increase over last year in Europe, excluding Russia, of 131 million cwt.; North Africa also has better prospects, while little change has to be recorded in India.) Taking all these figures together, the increase in the Northern Hemisphere was in July estimated at about 72 million cwt. (latest returns indicate 150 million cwt.). In the Southern Hemisphere, where seeding was going on at the time of the report, an acreage about equal to last season's was expected to prove a reasonable estimate (the latest Argentine official estimate is for an increase of over a million acres in that country).

While European production is higher than in 1922, the latter year was over 100 million cwt. below 1921; nevertheless, Europe only imported about 27 million more in 1922-23 than in 1921-22. The difference between crop deficit in 1922 and increased imports was apparently made up by (1) greater rye and potato consumption, (2) closer milling extraction, and (3) a probable reduction of European wheat stocks.

As regards Russia, the Conference consider that, while reports are conflicting, it is probable that the areas of wheat and rye this year are about one-half the pre-war totals, whereas the population is two-thirds of the pre-war population. With normal pre-war consumption this would admit of little or no export. Lack of farm animals, machinery and fertilisers, together with poor transportation, are factors indicating that Russia will not export large quantities of grain in the immediate future.

Owing to the world war there was a very great increase in the wheat acreage of the world, outside Russia and the Danubian countries. Before the War, Russia, Rumania and Bulgaria exported more than 100 million cwt. of wheat every year, or about 30 per cent. of all the wheat exported by exporting countries. Owing to the isolation of these sources of supply during the War, the acreage in four of the five other principal exporting countries increased; since the War it has decreased again very slightly. The changes are shown in the following table (thousands of acres):—

	Pre-War, 1909-13.	*War Peak, 1918-19.*	*1923.*
United States ...	47,097	67,437	58,253
Canada	9,945	18,240	22,165
Argentina	15,799	17,425	16,081
Australia	6,798	8,882	9,804
India	29,043	29,642	30,492
TOTAL (5 countries) ...	108,682	141,626	136,795

These five countries are growing 28 million more acres of wheat than before the War; and this considerably more than replaces the pre-war surplus from Russia and the Danube.

The five principal importing countries of Europe (United Kingdom, Italy, Germany, France and the Netherlands) whose average pre-war area was 34½ million acres under wheat, are now growing about 31 million acres, having recovered to that extent from the low point of 26 million acres reached during the War.

It is concluded that the expansion in the wheat area of the chief exporting countries, coupled with the decreased buying power of Western Europe, is responsible for the price situation which now prevails. It is also stated that significant changes have taken place in European methods of purchasing wheat. Before the War, wheat was bought in large quantities shortly after harvest for either immediate or forward shipment. Owing to the straitened financial conditions of European consumers, and difficulties incident to a fluctuating exchange, there has developed a tendency to purchase more largely from hand to mouth. This increases dependence upon American storage and financial facilities, and suggests the necessity of producers, bankers and handlers considering the advisability of more gradual movement from the farms to meet the new methods of foreign purchase.

The Conference conclude with the suggestion that the American wheat grower should take the first positive step this autumn to adjust his winter-wheat acreage in accordance with the world situation. This amounts to a recommendation to American farmers to reduce their wheat acreage. Since this Report was issued, an inquiry conducted by the Department of Agriculture among 25,000 farmers has elicited replies to the effect that they intend to reduce their winter-wheat area by 15½ per cent. If this were done by all farmers, it would imply a total area under winter wheat in the United States of some 39 million acres, whereas in the autumn of 1922 the acreage sown was over 46 million acres, of which 39,750,000 proved to be ultimately harvested, the balance (a higher proportion than normal, however) having been abandoned owing to "winter-kill." If the farmers carry out their intentions, and if only the average area is winter-killed, it would imply an area of rather over 35 million acres actually bearing a crop.

Maize and Hog Situation.—A special pig survey was taken on 1st June, from which it appears that there was more breeding this last spring than in 1922; also inquiries addressed to 140,000 farmers elicited the expressed intention to breed 28 per cent. more sows this autumn than in 1922. Probably the amount of breeding will be less than the expressed intention: last year the increase was only about half that stated in a similar inquiry. These investigations have revealed that hog producers in the United States are inclining toward autumn-breeding, making for a more even distribution of marketing throughout the year. The spring farrowings showed also that while the increase is due to increases in the Corn Belt (*i.e.*, the area in which the bulk of the maize is grown) and the western States, many of the important cotton States this year showed a decline, cotton apparently replacing some of the maize and peanuts there. As the indications given by the similar survey last year proved on the whole well founded, it would seem that, on the basis of this year's survey, provided that the mortality is no greater now than last year, the commercial market supply of hogs (over four-fifths of which comes from the Corn Belt) from the spring crop of 1923, should be about as large as that from the spring crop of 1922. If expressed intentions as to breeding are carried out; to the extent of half, as last year, the autumn crop of this year, which will be marketed next summer, will be larger than that of last. However, recent developments may cause farmers to market during July and August a considerable number of sows that they had intended to use for breeding this autumn.

During the last year or so, more hogs have been marketed than in any other like period in history, eight months' records showing an increase of 30 per cent. over the previous year, and 60 per cent. over a corresponding pre-war period. This greatly increased production has been due to the large maize harvests.

The maize crops of the last three years have been unusually heavy, and the price has been very low. To utilise the large surplus of cheap corn, hog production has been greatly expanded. This increase in hog production has now cleaned up the unusual surplus, with the result that the stocks of 1922 maize on farms were in July at about the pre-war average, and prices have recovered from their extremely low point. July prospects were for a normal 1923 corn crop (according to latest official statistics these prospects are somewhat improved). Thus the corn situation does not warrant the maintenance of the very heavy hog production of the past year; and if it is maintained, a maize shortage may develop by the summer of 1924.

The history of the past fifty years indicates that there is a rough general tendency towards over—and under—production of hogs in cycles of about 4 years from maximum to maximum. From the autumn of 1920 until that of 1922, hog prices were high relatively to maize. This high "corn-hog ratio" stimulated heavy breeding, with the results that hog prices fell until now (July) they are 25 per cent. below the 50-year average ratio. In spite of this sharp decline heavy breeding has continued, with the prospects that the unfavourable "corn-hog ratio" of the past months will last into 1924.

Considering the demand for pork and other pig-products, the Conference notes that the quantity in cold storage at the moment was not particularly excessive, and thus they conclude that there is no slackness in the demand. In the case of lard, stocks were below average, and thus the outlook for this was quite favourable. The population has already this year consumed 5 lb. of pig-products per head more than in 1922, and if this is maintained it would imply an annual consumption of 85 lb. per head, an amount only once exceeded 15 years ago. This heavy consumption may be expected without further serious decline in prices, since the active employment of labour has supported the pork market far beyond what might have been expected from a consideration of the heavy hog production. The ability to do so in future depends upon the maintenance of favourable industrial conditions.

The foreign demand for pig-meat has been unexpectedly large. The export trade takes approximately 10 per cent. of the total United States pig-products, and Europe has this year taken a decidedly larger proportion at a higher price than seemed probable. England and Germany still remain their principal customers, with considerable quantities also going to Belgium and the Netherlands. Britain's imports of lard have decreased, but the Continent has been taking more.

While the foregoing considerations indicate that the last of the 1922 pig-crop will be readily absorbed by the present market, the selling of this year's pig crop at a price on a level with the crop of 1922 is more problematical, and will depend on the continuance of active employment of labour in the United States and a favourable condition of the European market. The maintenance of the very heavy rate of pig production of the past year does not seem warranted by the maize situation.

In considering the domestic demand for farm products generally, apart from the two special factors just dealt with, it is pointed out that two facts stand out very clearly. The first is that there has been in the United States a very high level of industrial activity, distribution and consumption. Within the last twelve months the general level of prices has been fairly steady, the changes actually noted not being regarded as materially significant. The second fact is that throughout this period of great prosperity, the prices of most farm products, with the exception of cotton, and latterly of corn, have been abnormally low. The farmer, in marketing his produce, has had, much more than the manufacturer, to meet world conditions; and as a result agriculture has not generally shared in the marked recovery in 1922-3 in the United States. Owing to the general prosperity, the home demand for farm products has been near to if not at a maximum; the people can scarcely consume more of wheat and meat and other produce than they have done in the last year or more. The farmer therefore cannot now expect any immediate increase in the domestic demand. On the other hand the present full volume of employment and high wages are maintaining the consumption; and the probability of any severe depression in the near future seems to be slight; while lessening of industrial activity would probably affect only the demand for the choicer products, perhaps even thus increasing the demand for the cheaper grades of food. It is concluded, therefore, that, so far as domestic requirements are concerned, there is no special reason to expect a sharp decline in the average prices of farm products.

As regards foreign demand, European countries constitute the only significant markets for American agricultural products; and the position in the future depends mainly upon three factors: (i) the essential food requirements, depending partly upon crop conditions in Europe, (ii) the competition of other food-producing areas, and (iii) the purchasing power of Europe.

The European nations are gradually approaching their pre-war level, especially continental importing nations: Data showing this in the case of wheat have already been quoted. Crop conditions in Europe generally are much more favourable this year. Revival of production in Europe is much more manifest in agriculture than in manufacture.

In estimating the probable demand for American foodstuffs, adverse economic conditions may seriously reduce the consumption even of essential foodstuffs. Figures are given indicating that Germany's consumption of wheat in 1922 was only 55 per cent. that of 1913 and rye but 60 per cent. Barley and oats were but a third or a half, while potato consumption amounted to 93 per cent. There appears here a shifting from bread to potatoes. The extent of this shift is greater than the figures indicate, for it is stated that less potatoes are fed to pigs and more are reserved for human consumption. It is also stated that a similar shift is being made in many other countries of Europe.

Europe's purchasing power will depend upon the volume of her exports, the amount of her earnings on investments abroad, on shipping and other services. and on credits. The United States send more goods to Europe than they receive from her, though the balance has of late diminished moderately. There appears to be a shortage in the European production of manufactured goods—such as America requires—and moreover there is an increasing reluctance. as manifested in the tariff laws, to receive European goods. These factors. coupled with the Ruhr situation, and the necessity of the British Government to make large remittances on account of the nation's war debt to America, are all regarded as factors inimical to European buying power; and the conclusion is drawn that. unless the Ruhr situation is speedily cleared up, and a definite turn for the better takes place in Europe. there will probably be less foreign demand for American farm products this season.

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CO-OPERATIVE CHEESE-MAKING CENTRES IN SUSSEX.

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Cheese-making in Sussex on modern lines is of quite recent origin; in fact the production of milk itself on a large scale, now the most extensive branch of the agricultural industry of the county, is also a development which has come about practically within the last half century. Hence, the introduction of the first large dairy herds, kept primarily for milk production, is well within the memory of many still farming in the county. Until late years the demand in East Sussex for fresh milk has kept pace with the increased supplies available. The requirements of London and the south coast towns made it unnecessary to convert any appreciable amount of milk into either cheese or butter. It is true that on many of the smaller Wealden farms butter was made, and is still made to a limited extent, but the large producers of milk depended entirely on the sale of liquid milk.

For some few years before the war, however, the supply at certain seasons exceeded the demand, and this situation has now become intensified and is likely to become still more acute. Factories and retailers have hitherto generally taken the total output of the farmer at a fixed price, and under such conditions the price paid to the farmer was a price which enabled the retailer to recover any loss sustained in dealing with surplus milk which he could not profitably utilise. At the present time, however, most of the contracts entered into between producer and buyer are such that surplus milk is paid for at a rate which depends on the price of imported cheese. In Sussex the situation had therefore become more difficult than in many counties which have long been associated with the manufacture of cheese. In the western counties it has for years been the practice of milk producers to sell milk when satisfied with the price that could be thus obtained, sometimes throughout the year, but frequently only during the winter months. Such producers were thus always in a position to make the best possible terms with their buyers owing to an alternative outlet.

Demonstrations by the Agricultural Education Committee.—The unusual position of a county where supplies were tending to exceed the demand, and where alternative outlets did not appear to exist, was a factor which induced the East Sussex Agricultural Education Committee to adopt the Ministry's scheme for co-operative cheese centres. It is not an easy matter, however, to introduce innovations with rapidity into established agricultural conditions, so that before co-operative cheese-making centres could be successfully established, a considerable amount of preparatory work had to be carried out.

In 1918 cheese-making was started on a very small scale. Peripatetic work was undertaken dealing with quite small quantities of milk, the capacity of the vat used being only approximately 40 gallons. This peripatetic work, however, was sufficient to create an interest and also a favourable atmosphere.

The next step was to demonstrate at the County Farm, Plumpton, that it was a fallacy to imagine that first-class Cheddar cheese could only be made in such fertile districts as those existing in the west of England.

At the county farm, as on the majority of Sussex farms, no suitable place existed for making Cheddar cheese. A home-constructed dairy was, however, equipped out of part of a cart-shed. All work in equipping this dairy was done by the ordinary labour on the farm, except the installation of a boiler and steam fittings etc.

In addition to making into Cheddar cheese the milk produced on the farm, milk was purchased from adjoining farms, and during the months when the adjoining creamery could not readily deal with this surplus milk, Cheddar cheese was made. At the termination of the cheese-making season, the milk was sold at very favourable terms as accommodation milk.

In order to create further interest in the work, a large quantity of the cheese was sold by auction in Lewes market.

Despite the disadvantage of the roughly-equipped dairy, Cheddar cheese of very high quality was made, and the demand far exceeded the supply.

In 1920 some of the cheese made was exhibited at the Sussex County Agricultural Show at Chichester. In 1921 a considerable amount was again exhibited at the same Show at Hove, whilst at Hastings in 1922, the Sussex Agricultural Society awarded a special diploma for an " excellent exhibit of cheese." In 1923 at the Sussex Show there were 15 exhibits of Cheddar cheese, the first prize being awarded to that made at the county farm, and the second to the Hurstpierpoint centre. At each of these agricultural shows efforts were made to popularise the idea of utilising surplus milk for Cheddar-cheese-making.

FIG 1 — Lewes Co-operative Cheese-making Centre

FIG 2 — Press Room at the County Farm, Plumpton

FIG. 3 Cheese making Dairy at Hurstpierpoint

Hassocks Co-operative Cheese Centre, Hurstpierpoint.—In 1921 the Hassocks Branch of the National Farmers' Union, which embraces within its area the county farm, decided to establish a co-operative cheese centre at Hurstpierpoint. An old brewery was obtained which was equipped partly with the apparatus provided by the Ministry under its scheme, and partly by the guarantors of the centre. In order to provide working capital, the supporters guaranteed an overdraft at the bank. During the contracting period, at the end of March and the beginning of April, when some difficulty was being experienced in the district in disposing of milk, the centre was working up to its maximum capacity, but as soon as contracts were fixed, the centre temporarily closed until there was again a surplus of milk in May and June. The centre then re-opened and dealt with all the surplus milk available.

The work at this centre was supervised by the county instructress, whilst the local branch of the National Farmers' Union provided assistants who were trained with the object of conducting the centre when county assistance should be withdrawn.

Owing to the initial capital cost of equipping the centre with boiler, steam pipes, cheese racks, etc., the members could only pay out at the rate of 7d. per gallon for milk supplied during the first season.

Lewes Co-operative Cheese Factory.—The activities of the Hassocks Branch of the National Farmers' Union caused the adjoining district at Lewes in 1923 to equip a centre similar to that which had been so successfully run at Hurstpierpoint. In Lewes considerable difficulty was experienced in finding suitable buildings, but eventually room was found in another disused brewery. Such buildings may have been ideal for the production of beer, but very considerable difficulty was experienced, but eventually overcome, in adapting them for cheese-making.

The cost of equipment at the Lewes centre was appreciably lower than at Hurstpierpoint owing to the fact that steam could be obtained from a boiler originally used in connection with the brewery. In order to minimise expenditure in every possible way, the centre was equipped as simply as possible, partly by the supporters of the scheme, but chiefly by the apparatus provided by the Ministry, so that in May, 1923, the centre was able to deal with all the surplus milk of the guarantors which, at the maximum period, amounted to 240 gallons per day.

At the Lewes centre, 9,124 gallons of surplus milk were dealt with, and to their intense gratification the guarantors found that in closing their first season's venture, they were able to pay out to the guarantors 1s. a gallon for all surplus milk sent to the centre. This remarkably satisfactory state of affairs was to some extent due to the fact that owing to the difficulty of buying Colonial cheese in June, there was a keen demand for English-made Cheddar. A considerable quantity of the cheese was sold unripened at 1s. a lb., and as in its green state nearly 1¼ lb. of cheese was made from a gallon of milk, and as the whey was sold at 1d. a gallon, the return from a gallon of milk was extremely good. Later in the season the price of English Cheddar rose considerably, and higher prices could be obtained locally than were being paid for similar grade cheese in the cheese-making districts, especially as the cheese sold in almost every case went direct from the cheese-making centre into the retailers' shops.

Revised Rules for Lewes Centre.—In establishing the Lewes and Hassocks centres, rules based on those recommended by the Ministry were laid down and generally were found to work quite satisfactorily, but the guarantors of the Lewes cheese-making centre have now decided to put their centre on a somewhat different basis, as the farmers supporting this centre feel that all the cost should not fall on those sending milk to the centre, especially when, as in a county like Sussex, the cheese-making period can generally only extend over a short period. The guarantors of the Lewes centre, therefore, have decided to extend their activities, and instead of defraying all expenditure in connection with such centres out of the milk actually sent, to pay general establishment charges by subscriptions from members.

The following particulars and rules were circulated by the supporters of the Lewes scheme at the termination of the first season's enterprise.

"The guarantors of the Lewes Co-operative Cheese Factory invite dairy farmers in the Lewes district to join with them in continuing and expanding the centre. They especially desire to point out to dairy farmers the following advantages of being connected with such a centre :—

1. *Surplus milk in April, May and June* can be made into Cheddar cheese. This enables farmers, usually, to not only secure a better price for their surplus milk, but also to obtain better terms from their retailers for their remaining milk.

> 2. The factory will be able to deal temporarily, at contract time, with unsold milk, thus enabling members to make the best possible terms concerning their milk.
>
> The guarantors in connection with the above would point out that during the past season the centre has been very helpful to them and that instead of the guarantors receiving the prices of 10½d. and 7½d. payable for surplus milk in May and June, it is hoped that the guarantors will share out at the rate of 1s. per gallon.
>
> The following are necessary rules and conditions in connection with the Lewes centre.
>
> Guarantors must subscribe towards the rent and general expenses in connection with the centre at the rate of 2s. per cow, 1s. to be paid on the 1st October, and the balance on the 1st April, with a maximum of £5.
>
> From the guarantors will be elected a management committee to deal with the work of the centre.
>
> The management committee reserve the right to accept, or decline, surplus milk. Should they be unable to accept milk any subscription paid will be refunded.
>
> *The guarantors of the Lewes centre wish to point out that they have already equipped the centre* and have obtained an option of a lease of the premises and, further, that as regards any additional equipment which may be necessary to deal with larger quantities of milk, a guarantor has advanced £100 for such equipment, which can be repaid from proceeds received at the centre extending over a period of three years.
>
> The guarantors desire also to point out to dairy farmers *that during the past season they have dealt with approximately* 9,000 *gallons of milk at Lewes*, that there are similar centres run by the Hassocks and also by the Steyning Branches of the Farmer's Union. By supporting such centres dairy farmers will be rendering invaluable assistance to the dairying industry in East Sussex."

The guarantors of the Lewes scheme were confident that they could largely increase the number of members who would now support the Co-operative Centre, but they wish to have the benefit of another year's experience before embarking on what will ultimately undoubtedly be a much wider scheme of co-operation between milk producers.

In connection with the Lewes cheese centre, one of the most gratifying things has been the ready assistance of the local branch of the Women's Institute in disposing of much of the cheese made.

In the meantime, the work which had been carried out by the Hassocks Branch of the National Farmers' Union had aroused the interest of the adjoining branch at Steyning, which comes within the administrative county of West Sussex. At the commencement of the establishment of this centre, a student who had been trained in cheese-making at the county farm at Plumpton, carried on the centre until other arrangements could be made.

The cheese-making centres of Sussex which have, during the last few years, grown from such a small commencement, have not necessitated any large amount of capital expenditure to be borne by members. The buildings invariably have been of the simplest kind, whilst the amount subscribed under the Lewes scheme is such that farmers generally are willing to subscribe to it as an insurance policy enabling them to deal with surplus milk.

Further, such centres are not inimical to the interests of the retailers of milk; as a matter of fact two of the most prominent supporters are amongst the largest distributors in Sussex.

Since the movement has extended from Plumpton to the Hassocks, Lewes and Steyning Branches of the National Farmers' Union, it is the intention of the Agricultural Education Committee to foster similar centres throughout East Sussex wherever such can be established, as the Committee feel that no better assistance can be given to milk producers in this time of stress than enabling them, by providing technical instruction, to deal co-operatively with milk, on which so largely depends the prosperity of the agricultural industry in Sussex.

Ministry's Scheme of Assistance.—The development of cheese-making centres in Sussex could not have been carried out but for the assistance received in connection with the Ministry's scheme for aiding the formation of co-operative cheese schools.

It is probable that this scheme is known in most counties, but it may be useful to give a brief outline of it.

The Ministry, with the object of providing local demonstrations of the possibilities for co-operative action by milk producers, and of giving instruction in certain branches of dairy technique, has urged County Agricultural Education Authorities in whose area milk production is practised to any considerable extent, to conduct co-operative dairy schools at suitable centres where the local milk producers express a desire for assistance. A school located at an approved centre would operate for from three to six months, or until an adequate demonstration has been provided

The local milk producers must agree to contribute on a co-operative basis for the use of the school, a daily quantity of milk—usually fixed at about 200 gallons, and must appoint from amongst themselves a local committee of management to act under the guidance of the agricultural organiser and the school instructor.

The Ministry lends to the authority most of the equipment, and contributes two-thirds of the instructor's salary and of other expenses incidental to the instruction. The Ministry's technical staff is also willing at all times to assist with technical advice.

It is of course not required that the farmers taking part in the demonstration shall subsequently form a co-operative society. They are left to form their own decision in the light of the results of the school.

It is not the purpose of this article to deal fully with the scheme, but all interested in such work are advised to apply for information to their County Agricultural Organiser or to the Ministry.

* * * * * *

CONSTRUCTION OF SILOS.

WALTER E. SAWYER

OF late there has been much discussion on the cost and style of various silos, and it is felt that particulars and illustrations of certain types of silos may therefore be of some interest. With the exception of the last (Fig. 2), which was built of blocks and was put out to contract, all these silos were designed and built under the personal supervision of a thoroughly practical farmer, farming his own land. As regards the labour, that, too, was all untrained. The first silo was built with German prisoner labour, and without the use of scaffolding of any kind, but an internal ladder and jenny wheel. The others were built by men usually at work on the farm. The scaffolding used was suitable timber usually available on an ordinary farm.

Owing to varying wages the cost is given in hours or days, and materials in quantities, so that it is quite simple to work out the total cost at the present price of labour and materials

The first silo illustrated (Fig. 1) was built with German prisoner labour, *in situ*, with forms 2 ft. 3 in. by 12 ft. 6 in. and 8 in. thick. The material used was 12 tons of cement and 60 yds. of shingle and sand. The mixture used was 1 part of cement, 3 parts of sand and 4 of shingle, reinforced both ways with old iron. It was built at the rate of three rings per week, to allow of the proper setting of the concrete. The bottom is drained and stands on gravel The average labour was .5 men per day. The entire quantity of material was hoisted by a jenny wheel attached to a ladder inside. The total height is 40 ft. and diameter 16 ft., with an approximate capacity of 180 tons. This silo has a slightly domed top and openings at intervals at the side, covered by a chute of galvanised iron, so enabling the silage to be thrown out as wanted, directly on to a wagon or tumbril. A fixed ladder runs the whole way up, joined to the silo within the chute. The material as cut goes up through an iron tube to the top of the silo, through a hole, and is then directed downwards from the centre through a flexible iron tube, so that it is equally distributed all over the floor. In practice, as the silo is being filled a man treads the material down as it is delivered out of the spout, and by directing the flow keeps the material evenly pressed and prevents any looseness near the walls, which might allow of deterioration of the silage.

The actual filling of the silo is carried out by an ordinary Maynard chaff cutter adapted for the purpose. The knife delivers directly into a sunken receptacle with a blower attached which forces the cut stuff up the delivery pipe and through the hole in the top into the silo. The crop used in this case was from a mixture of 5 pecks of tares and 3 pecks of oats per acre, which yielded about 13 tons per acre. The filling took place continuously, only the nights and Sunday being left for settling, the amount dealt with being about 30 tons per day. Usually the silage is left for three months before being broached and then is fed to cattle and other stock. The owner considers the relative value of this silage for rough comparative purposes as roots 100, silage 175, or hay 100, silage 33. The amount of waste entailed by making the silage and through loss of weight is reckoned as about 5 per cent. of water and 3 per cent. outsides, tops, etc.

The second silo (Fig. 3) was built under exceptionally economical conditions. On the estate, within a few hundred yards of the farm premises and on the way to the town, there is a gravel pit. By cutting away back to a perpendicular straight wall it was possible to erect a 15-ft. silo, which could be filled from the top and emptied through the various side openings or windows into carts or waggons when required. In this case the rough sand and shingle were obtained as the site was excavated. The particulars of this silo are :—Height 15 ft., diameter 12 ft., capacity about 3,000 to 4,000 bushels of wet grains. This silo was built by two men in 24 working days. The forms used were 1 ft. 6 in. by 3 ft., making walls 4 in. thick and one ring every 24 hours. The mixture used was 1 part cement, 3 parts sand, 4 parts shingle, reinforced with old iron. The total cement used was 2¾ tons. As the sand and shingle came from the excavation and the labour is included in the 24 days of the whole work entailed of excavating, building, water carting, etc., this was

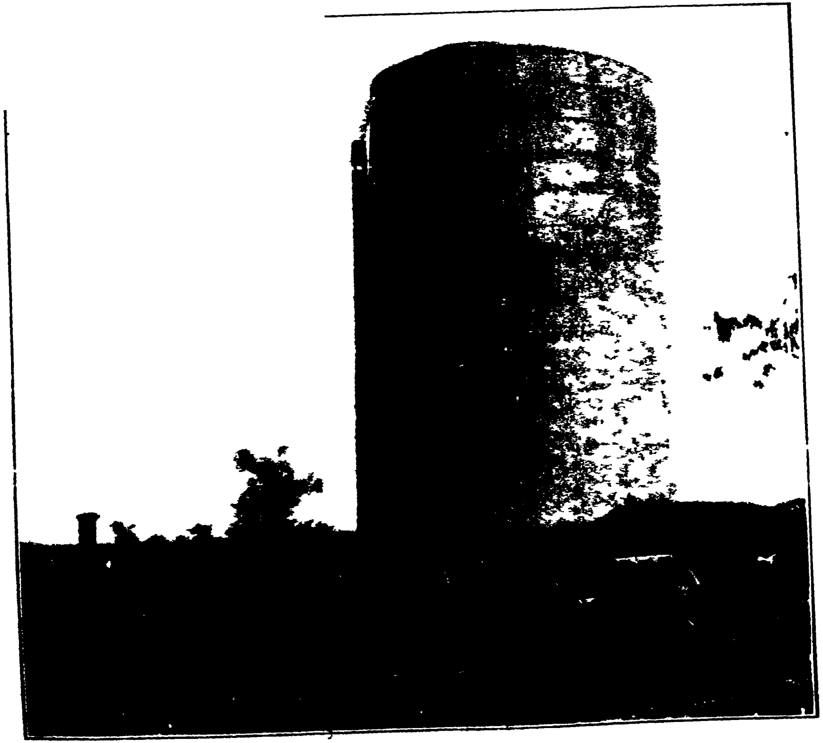

Fig 1 —Reinforced Concrete Silo at Brandon

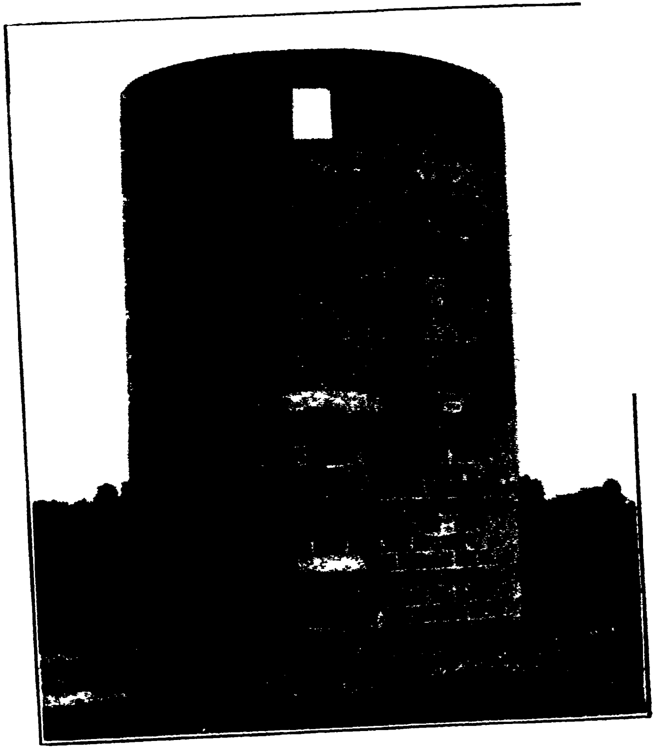

Fig 2 Concrete Block Silo at Belchamp.

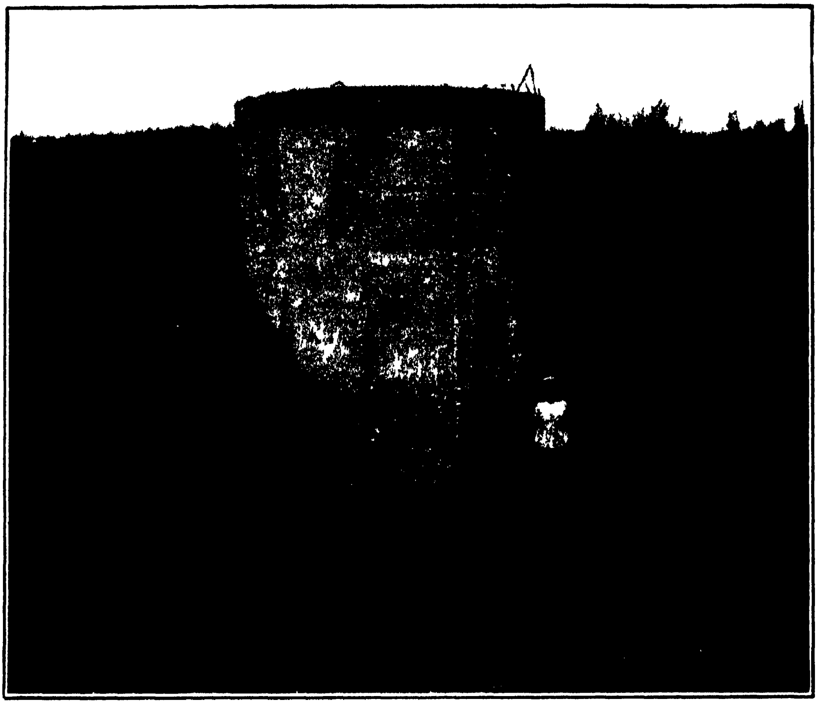

FIG 3.—Reinforced Concrete Pit Grain Silo at Brundon

FIG. 4.—Reinforced Concrete Water Tank at Brundon.

a very cheap silo. There are three windows or openings for emptying the silo. In this case the bottom is solid cement without drainage.

The grains ensiled here are bought during the cheap period when flush of grass makes them practically unsaleable, and stored for use during the winter months. The shinkage. principally water, is about 10 per cent. The grains are used for cows, partly to replace concentrated food at the rate of ⅓ bushel per day, a typical ration being 50 lb. silage, ⅓ bushel ensiled grains, ⅓ bushel fresh grains, 3 lb. concentrated food, and 7 lb. dry cut chaff.

Another silo (Fig. 2) was built on an off farm under contract on 1922 costs for £170. It is built of concrete blocks with horizontal reinforcing only. The blocks were made on the site and the mixture was about 5 parts sand and 1 part cement. The floor has drainage. but there is no roof. It is 30 ft. high and has a diameter of 16 ft., with an approximate capacity of 120 tons.

It may be of interest to add a note on the construction of a farm water tank. Fig. 4 gives an idea of how the water supply for the farm and dairy is arranged. In this case a concrete bottom and foundation was built, upon which the walls of the water tank were erected. This tank was built *in situ,* with forms 1 ft. 3 in. by 3 ft., and making the walls 4 in. thick. The mixture used was 1 part cement. 2 parts sand. and 4 parts shingle. The whole work was reinforced with old iron, and one ring was built per day. A top was made with wooden supports to hold the reinforced cement top until dry. The labour was entirely unskilled and, including the raising of sand and carting from a near-by gravel pit. the time taken was 2 men for 12 days. The tank is 8 ft. high, and has an internal diameter of 12 ft., holding approximately 5,700 gallons. The water is pumped in through a hole at the top, and for use is drawn off half-way up through a tap and also through pipes to the horse- and cow-yards and sheds. etc., by gravitation only. There is also a hole at the very base of the tank allowing all the water to be drawn off for cleaning purposes. It is filled by a 3-in. centrifugal pump coupled direct to a De Dion petrol engine which easily fills the tank in 75 minutes. using about three pints of petrol.

The writer wishes to thank Mr. Cecil Whittome, Brundon Hall. Sudbury, Suffolk. for kind permission to publish the photographs illustrating this article.

* * *

THE WORKING OF THE SEEDS ACT, 1920.

DURING the season 1922-23 9,000 inspections under the Seeds Act, 1920, have been made by the Ministry's outdoor staff. These inspections have included the premises of the large wholesalers, the retailers' shops, shops where seeds are sold merely as a sideline during a limited period of the year, markets, auction-marts and farms.

With the exception of certain points which will be referred to in detail below the Regulations now appear to be thoroughly well understood by the majority of seedsmen, and are being complied with in a satisfactory manner.

Control Samples from Bulk.—The number of control samples taken from bulks during the season amounted to 583, and included 159 samples of clovers, 105 of grasses, 11 of field seeds, 49 of roots, 241 of vegetables and 18 of cereal seeds.

67 of these samples, mainly clovers and grasses, showed as a result of the official check test, that the declarations made by the sellers were incorrect in some material particular. In 19 cases the germination differed by from 10 to 15 per cent., 6 differed by from 15 to 20 per cent. and 9 were wrong to the extent of over 20 per cent. in the germination figure. In 6 cases the purity was shown to be from 3 to 5 per cent. out, another 6 differed by from 5 to 10 per cent., and there was one case in which the purity was declared as more than 10 per cent. higher than was shown by the check test. The principal sources of error in the remaining cases were omissions to state the presence of dodder in clover, and incorrect statements as to the presence of injurious weed seeds. In all cases where the check test showed a marked discrepancy from the vendor's particulars, the matter has been taken up with the person concerned.

Packeted Seed.—A notable improvement is shown in connection with the small packet trade. It would appear that the Act is having the effect of gradually driving the greater portion of this class of trade into the hands of a few big firms who understand what is required of them and who are distributing good quality seed. Of the 260 control samples of packeted seed taken during the past season 88·9 per cent. were shown by check tests at the Official Seed Testing Station to be at or above the minimum percentages of germination and purity laid down in the Regulations; 3·3 per cent. were below the minimum but above two-thirds; and the remaining 7·8 per cent. were below two-thirds of the minimum. Most of the samples falling within the latter group were of packets taken on the premises of small sideline dealers which had been carried over from previous seasons. Appropriate action has been taken by the Ministry in all these cases.

Licensed Private Seed Testing Stations.—Tests for the purposes of the Seeds Act, in the case of seeds other than garden seeds, must be made at one of the official testing stations, or at a station licensed by the Ministry for that purpose. The total number of licences issued to date for this purpose in England and Wales is 84, and includes 29 to test all kinds of seeds covered by the Act, 4 to test all kinds of seeds except grasses and clovers. 1 to test clovers, ryegrass, cereal and field seed, 7 to test field and cereal seeds, 5 to test field seeds and 38 to test cereal seeds. Of these licences 16 have been issued since August, 1922, and include twelve for testing cereal seeds only.

One of the greatest difficulties experienced in administering the Testing of Seeds Order, which was the forerunner of the Seeds Act, arose from the variation in the results of tests carried out by the various analysts. By confining testing for the purposes of the Act to official and licensed stations this difficulty has been reduced to an appreciable extent, but there is still a considerable amount of divergence in results which causes trouble both from an administrative and a commercial point of view. Up to the present a certain amount of freedom has been allowed to these licensed stations with regard to the methods they employ for testing, but it is increasingly evident that a much higher degree of uniformity in methods is necessary in order to obviate discrepancies in results between the various licensed stations and between these stations and the official stations.

In order to check the results of tests carried out at licensed stations the Ministry has taken from these establishments, during the past season, some 670 special samples. The check tests carried out at the Official Station have shown that in 20 per cent. of these samples, discrepancies have occurred—mostly in the percentage of germination—greater than the prescribed limits of variation. In fairness to the licensed stations, however, it should be pointed out that Inspectors are naturally inclined to draw samples of those kinds of seeds, such as oats, trefoil, mangolds and peas, which are known to give varied results, so that so large a percentage of discrepancy as 20 per cent. would not hold for all the tests carried out at these establishments.

At a well attended conference of official and private seed analysts held at the English Official Seed Testing Station on the 10th August, 1923, this question of discrepancy in results and the importance of uniform methods of testing being employed was discussed in great detail and it is hoped that, as a result of this conference, a series of instructions for testing will be laid down which will considerably reduce the variation in results at present obtained.

As a further means of securing uniformity in methods and results it is intended that the Official Seed Testing Station shall from time to time issue to all licensed stations appropriate samples of seeds for comparative testing. The results of all these tests will be collected and examined and recommendations made for changes in methods, consistent with the evidence produced.

Another step towards uniformity is to require that all analysts in charge of licensed stations shall take one of the courses in seed testing which are arranged for at the Official Seed Testing Station each summer.

The variation in results obtained at different stations is not confined to this country alone, but is a difficulty which is met with in all countries where seed testing is carried on. This problem received considerable attention at the Third International Seed Testing Congress held at Copenhagen in 1921, and has since been the principal study of the "Association of Seed Analysts and Seed Control Organisations of Europe" which was formed at that Congress.

It is of interest to note here that the Fourth International Seed Testing Congress is to be held in London and Cambridge in July, 1924. A Committee appointed by the Ministry is making the necessary arrangements, and invitations to send official delegates to the Congress have already been issued to all the principal foreign countries and to the British Dominions and Colonies.

Cereal Seeds.—Opinion remains divided as to the desirability of cereal seeds being included amongst the kinds of seeds covered by the requirements of the Act, and considerable difficulty is met with in the administration of the Act in this connection. It is unfortunate that the circumstances under which a large proportion of the sales of cereal seeds are effected are such that it has been found necessary to authorise a delay of up to a month in the delivery to the purchaser of the statement as to quality.

It seems clear, however, that it is better that the purchaser should receive particulars as to the quality of the seed a week or so after the seed itself has been delivered than that he should be supplied with no particulars whatever.

The commonest argument against the inclusion of cereal seeds is that anyone with experience in handling seed corn can estimate its capacity for germination by eye with sufficient accuracy for practical purposes. Numerous tests at the Official Seed Testing Station show, however, that cereal samples are extraordinarily deceptive as regards their germinative capacity, many plump good looking samples giving germination results of as low as 40 per cent., while many samples of poor shrivelled and bad coloured grain have given results well above the minimum percentage prescribed by the Regulations.

Seed Potatoes.—Next to cereal seeds, seed potatoes give the most trouble as regards the administration of the Act. To a great extent the reason for this is that seed potatoes are sold during a very short period of the year by a very large number of small traders, and it is consequently extraordinarily difficult to keep in touch with this trade. In practically every case investigated the necessary statement required under the Act, viz., the class, variety, size and dressing, appeared on the invoice supplied by the merchant, but either through ignorance or carelessness the small retailer frequently neglects to display these particulars alongside seed exposed for sale or to deliver a written statement to the purchaser in the case of a sale.

It has been suggested that the Act should not apply to sales of small quantities of seed potatoes of less than 112 lb. It is considered, however, that it is just this class of purchaser, the allotment holder and gardener, who buys his seed in small lots, who requires the protection of the regulations. The big buyer has more experience and is less easily fobbed off with unsuitable seed. A frequent source of trouble is the practice of merchants passing on orders to a grower for direct delivery to the purchaser and not taking sufficient care to ascertain that the particulars as to class, variety, size and dressing are accurate. It is suggested that merchants in their own interests, should take such steps as are necessary to see that the potatoes loaded by the grower correspond with the description given to the purchaser.

Sales by Auction.—Large quantities of seed potatoes are sold by public auction, and difficulty is experienced from time to time in getting the necessary particulars displayed and delivered. As a general rule auctioneers are very helpful in this respect in pointing out to the sellers the requirements of the

Regulations. The auctioneer, however, is acting merely as an agent for the seller and is, therefore, not directly responsible for the necessary declaration. It should be clearly understood that a sale of seed potatoes by public auction is affected by the Seeds Regulations to exactly the same extent as a private sale.

Propaganda.—In addition to the normal practice of distributing a large number of leaflets describing the Act, arranging for lectures at meetings of farmers, etc., efforts are now being made to get into touch with farmers by means of a special seed exhibit at a number of Agricultural Shows. The interest displayed in these exhibits has been very encouraging, and it is believed that this is one of the best methods of bringing home to the farmer the necessity of sowing only tested seed and thereby checking the practice of direct farmer to farmer sales of untested seed, which is so undesirable, but so difficult to prevent.

Distinctive Name of Variety.—The Seeds Regulations (Reg. 3 (1) (*c*)) require in the case of a sale, or exposure for sale, of Cereals, Red Clover, White Clover, Crimson Clover and Sainfoin, that the distinctive name of the variety of the seeds must be declared, or if the distinctive name of the variety is not known, or the stock is mixed, a statement must be made to that effect.

In practice this Regulation is generally complied with, except in the case of Red Clover, in connection with which much regrettable confusion exists. Red Clover is variously sold as "Red Clover," "Cowgrass," "Single Cut Cowgrass," "Perennial Red," "Giant Hybrid Cowgrass," "Late Flowering Red," "Common Red," "Broad-leaved Red," and "American Mammoth."

There are, however, only two distinctive varieties of Red Clover, one the Early or Broad Red Clover which is favoured for its production of spring and winter growth and for the good aftermath, and the other the Late Flowering Red which is the more persistent variety and therefore most useful for long duration leys or for permanent pastures. As these two groups are so clearly defined and each has its own particular characteristics and value there is no excuse for the present multiplicity of names. Moreover it is of the utmost importance that the farmer should know the type of seed he is buying.

Country of Origin.—It is beginning to be realised that valuable as is the information required to be disclosed in the case of a sale of seeds as regard the purity and germination, these particulars are only preliminaries when the importance of variety, strain and nationality are considered. The Seeds' Act requires the country of origin to be disclosed in the case of a sale of clovers and grasses, but it is probable that too little weight is given to this information. When considering the quality of a lot of seeds the farmer is well advised to look to the country of origin in the first place, and to examine the figures as to germination and purity in the light of this information. When given the choice between a lot of red clover seed grown in America or France or Italy with a high percentage of purity and germination on the one hand and a lot grown in England or Wales with a germination and purity of a lower percentage than its foreign rival on the other, the farmer is well advised to choose the latter as it will almost certainly give him a more satisfactory crop. No tests can specify the constitution of the seed, but all trials indicate that home-grown seed furnishes a higher proportion of plants capable of standing the winter under our conditions of soil and climate.

It is said that one of the results of the Seeds Act is that too much attention is being directed to germination and purity, and that consequently home-grown seed which in many cases cannot compete with foreign seed as regards purity, germination and appearance, is becoming less popular with the farmer and, as naturally follows, with his supplier the seedsman. Too much stress, therefore, cannot be laid on the distinct advantages of using home-grown seed even though it may show a lower percentage of germination and purity.

In this connection it is of interest to draw attention to the two Associations recently formed in Wales, the "Vale of Clwyd Red Clover Growers' Association," and the "Montgomeryshire Welsh Clover Growers' Association," particulars of which were given in this *Journal* for September, 1923. The main object of these Associations is to foster the growth of the two special strains of red clover grown in these districts, to provide for the certification of the true strains and the testing of the seeds under the Seeds Act.

Prosecutions.—Legal proceedings for infringements of the Seeds Act have been taken in 9 cases during the season 19[illegible]. A summary of these cases is given below.

In June a Portsmouth firm of seedsmen were prosecuted for selling packets of vegetable seed bearing labels which indicated that the seeds were up to the authorised minimum standard of germination prescribed by the Seeds Regulations, but which, on being tested, were found to be much below the prescribed figure. Four separate summonses were issued, one in respect of each of the samples taken, and a fine of £1 was inflicted in each case with a total of two guineas costs.

A local tradesman, who deals in seeds as a side-line, was brought up at Beaumaris Petty Sessions on 30th June on charges of (1) failing to deliver to an Inspector who took a sample of seeds a copy of the particulars declared with regard to purity and germination, and (2) exposing the seed for sale without a statement of these particulars being displayed on or near the seed. The first summons was dismissed on payment of costs, but a fine of 10s. 6d. was imposed on the second charge, and an advocate's fee of a guinea was allowed.

A similar case against an Anglesey shopkeeper was heard at Valley Petty Sessions on 9th July, the charges being identical with those in the case previously mentioned, the defendant was fined the sum of 5s. in respect of each charge.

On 16th July, a case was heard at Llangefni when the defendent, a local draper and seed merchant, was convicted of failing to deliver to the Inspector who took the sample a copy of the particulars with regard to the purity and germination of a parcel of yearling seed which had not been re-tested. A fine of 10s. was imposed in this case.

At Dolgelly a summons against a firm of general storekeepers was heard on 24th July, the charge being the same as that in the preceding case. The defendant pleaded ignorance, but the prosecution was able to show that attention had been particularly called to the requirements of the Act a year previously, and a conviction was obtained, the defendant being fined £2 10s. and a guinea costs.

A prosecution for failure to deliver a statement showing the prescribed particulars in the case of a sale of seed potatoes was heard at Stratford-on-Avon on 1st August. The sale was a cash transaction, and the defendant took the line that the potatoes were not sold as seed. It was possible, however, to convince the Bench that they were, in fact, sold for planting, and a fine of 10s. was imposed.

On 25th August at Colwyn Bay Police Court a charge of making a false statement in connection with the sale of packets of seed was heard. The seed in question was parsnip which was guarantêed to germinate to not less than the minimum percentage mentioned in the Seeds Regulations. On being tested at the Official Station, however, it was ascertained that the seed was dead. A fine of £1 was inflicted in this case and an advocate's fee of a guinea was allowed.

Two charges were heard at Bangor on 4th September against a Llanfairfechan tradesman in respect of (1) failure to display the prescribed particulars in respect of seed exposed for sale, and (2) making a false statement with regard to the germination of seed. On the first charge, which was based on a Control Sample taken by an Inspector, the defendant was fined £1, and 1½ guineas advocate's fee was allowed. In the second case, however, the packet of seed in question had been purchased on behalf of the Inspector by a private individual, and the defendant was able to claim that some doubt existed as to whether the seed tested was, in fact, that purchased from him. The summons was, accordingly, dismissed on payment of costs.

A charge of making false statements in connection with the sale of three consignments of seed potatoes was heard at Chatteris on 4th September, the defendants being a well-known local firm of seedsmen. Samples of the three consignments had been taken by an Inspector from a shop in Oundle in March and grown on at Ormskirk, the results showing that the variety had been wrongly described in each case. A fine of £3 was inflicted.

A firm of seedsmen were prosecuted at Taunton on 5th September, the charges being (1) making a false statement respecting a sample of trefoil seed, and (2) failing to deliver to the Inspector who took a sample of red clover seed the prescribed statement. In the first case it was admitted by the defendant that a certain amount of yearling seed had been added to the sack from which purchasers were supplied, and that the particulars he was declaring were those supplied to him in respect of the new seed. A fine of 10s. was imposed in this instance. On the second charge the defendant pleaded that he had omitted by an oversight to have the seed re-tested, and as the seed was found to be of good quality the Bench dismissed the summons on payment of two guineas costs.

Amendments of Seeds Regulations.—No amendments have been made in the "Seeds Regulations, 1922," so that, unless some unforeseen circumstances should arise, the Regulations will be the same during the season 1923-24 as those which were in operation last season.

Copies of the Seeds Act, 1920, and of the Seeds Regulations, 1922, may be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C., price 3d. each.

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THE CONTROL OF APHIDES ATTACKING SPROUTING POTATOES.

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IN a recent paper* F. V. Theobald describes the species of aphides (green flies or plant lice) attacking potatoes in this country, three of which have occurred on sprouting tubers, and it is stated that such attacks are frequently severe. The species concerned are *Macrosiphum solanifolii*, Ashmead; *Myzus persicæ*, Sulzer, and *M. pseudosolani*, Theobald. In January, 1921, the writer investigated a severe attack on boxed sets at Holyhead, and has since found that similar cases are by no means rare. The species in all these North Wales cases has been *M. persicæ* (of a form named by Theobald *tuberoscellæ*, but now regarded by him as merely a variety of *persicæ*). This common species occurs on a considerable number of host plants, both out of doors and under glass, as well as on the potato, and is one of the species accused of transmitting diseases of the virus group. It was taken on field potatoes in small numbers in 1922, and has been fairly common this season (1923), especially in some sheltered gardens. The strain of aphides obtained at Holyhead has been maintained in the laboratory at Bangor on sprouting potatoes, and a number of observations have been made as to its habits, etc., while some experiments have been conducted with the object of determining a method of control at once easy of application and harmless to the sprouting tubers.

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* "The Aphides attacking the Potato," F. V. Theobald, S.E. Agric. College, Wye, 1922.

Breeding Experiments.—*M. persicæ* breeds very rapidly on boxed potatoes throughout the winter under sheltered conditions, and not only causes shrivelling of the sprouts, but coats the tuber with sticky "honeydew" to which adhere the cast skins of the insects. On 23rd January, 1921, at Holyhead, well-sprouted tubers of Sharp's Express, Ally and Majestic were smothered with all stages of the pests, while winged females were abundant Many varieties have been tried, and all appear equally liable to attack. On 7th November, 1922, a few viviparous females were transferred from shrivelled tubers to the young haulm of potatoes grown in pots, and by 4th December, dense colonies had formed, and the young shoots were withered and nearly dead, while winged forms were produced by 6th December. On the 11th December single apterous females were moved to sprouts of several varieties of tubers, and colonies were forming on the 25th, while by 10th January, 1923, the infestation could be described as "heavy" and a few winged forms were to be seen. These winged aphides fly to the nearest window, where they congregate in hundreds, but if placed on fresh potato sprouts they will frequently settle down and produce colonies.

During the period mentioned above the temperature of the laboratory varied considerably, going as low as 46.5 deg. F., and as high as 61.5 deg F. Another series on Dargill Early was tried in an unheated room. Ten tubers were colonised with a single female each on 10th January, 1923, and on 18th January showed increases ranging from 7 to 15 larvæ (with an average of 10). Other females placed on Sharp's Express on 11th January, each produced from 3 to 8 young by the 18th January.

Removal of aphides from sprouts to foliage succeeded in the laboratory, but not under garden conditions in May, 1922, under unusually fine warm weather conditions, and only to a slight extent in May, 1923; but plants infected on 25th May showed numerous larvæ by 16th June.

In January, 1923, several hundred sprouted tubers were obtained from the College Farm, and colonised with *M. persicæ*, and these were used for a series of experiments on the control of the aphides.

In 1922 and 1923 series of heavily infested tubers were planted at various stages of attack. If the attack has not been of too long duration, good plants result; but if the sprouts become shrivelled, only weak plants are produced, while in some instances death follows planting. Planting kills the aphides; in only one instance (May, 1923) was a single aphis found on a plant grown from an infested tuber, although forty such were examined.

Control Experiments.—For control, fumigations with a preparation containing tetrachlorethane were tried; also paradichlorbenzene (crystal and fluid), and a nicotine sulphate dust containing 5 per cent of nicotine sulphate (40 per cent. black leaf) equivalent to 2 per cent. of pure nicotine.* The tubers were examined after treatment and again 48 hours later, and were finally planted in a garden in the ordinary way in order to observe any effects of treatment on subsequent growth. Preliminary tests were made with a few tubers planted in pots.

All the substances used killed the aphides, but in the case of paradichlorbenzene several hours' exposure to the fumes was required to kill all the insects, owing to the temperature being too low to allow of the gas being fully effective.† The tetrachlorethane preparation killed rapidly at ordinary laboratory temperatures (between 50 and 60 deg. F.), the exposure being reduced to one hour and being quite effective then.

The nicotine sulphate dust was applied by means of hand bellows, two or three puffs sufficing for a box of tubers. The aphides were affected almost at once, and few survived half an hour after treatment.

The following series were planted. 106 tubers in all:—

I. 16 tubers of Sharp's Express heavily infested with *M. persicæ*, and exposed to the fumes of paradichlorbenzene for 4 hours at 54-56 deg. F., 4th April, 1923.

II. 30 tubers of Sharp's Express, heavily infested, and exposed to fumes of tetrachlorethane for one hour at 52-56 deg. F., 3rd April, 1923.

III. 30 tubers Sharp's Express, heavily infested and dusted with nicotine sulphate at 52-56 deg. F., 26th March, 1923.

IV. 30 tubers Sharp's Express, heavily infested, planted without treatment.

On 24th May all these were carefully examined and all were up.

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* The writer is indebted to Messrs. Murphy & Son, Ltd., for kindly supplying this dust.

† "Paradichlorbenzene as an Insect Fumigant," A. B. Duckett, U.S. Dep. Agric., Bull. 167, 1915, p. 2.

The first and second lots were markedly backward and weak, as compared with the rest; some being barely above the surface, and none more than 5 in. in height.

Lot III, treated with nicotine sulphate dust, and the untreated lot. were for the most part strong and vigorous, with here and there a backward one (due to the weakening effects of aphis attack), and were from 4 to 8 in. in height. The crop was raised and weighed on 26th July, with the following results:—

I. 10 plants from tubers fumigated with paradichlorbenzene yielded a total of 2 lb. 9 oz., a marked feature being the large number of very small tubers.

II. 10 plants from tubers fumigated with tetrachlorethane yielded 4 lb. 4 oz.

III. 10 plants from tubers dusted with nicotine sulphate yielded 8 lb. 6 oz.

IV. 10 plants from tubers not treated prior to planting yielded 8 lb. 6 oz.

The relatively low yield must be attributed to the results of aphis attack; while the effects of fumigation with paradichlorbenzene and tetrachlorethane may possibly have been intensified by the previous severe injury by the aphides. It may be mentioned that Speyer* has noted that fumigation experiments with tetrachlorethane showed remarkable variations as regards the susceptibility of certain plants to injury by it. Further investigation is required in this connection. It should be noted that the tetrachlorethane used was not pure, but a proprietary preparation.

It might appear, from a casual examination of the results, that, although nicotine sulphate effectively killed the aphides, there is no advantage in the treatment, as the crop from the treated tubers was no better than that from untreated seed. This is hardly a fair conclusion. Both treated and untreated seed had, before planting, been seriously weakened by the aphis attack, and had the nicotine sulphate been applied when the attack commenced, say in January (instead of April), the results might have been very different.

When the presence of aphides is noted on sprouting potatoes. treatment should be undertaken at once, as the earlier this can be applied the better, before the aphides have had time to weaken the sprouts Potatoes intended for seed should therefore be examined from time to time. as the attack may easily escape notice, especially in the early stages. Later the pale cast skins of the insects adhere to the sprouts, drawing attention to their presence, and still later marked shrivelling is seen. Treatment by means of the 5 per cent. nicotine sulphate will prove most effective on potatoes sprouted in boxes, etc., in single layers (as in the case of the experiments here described). The tubers are thus freely exposed to the fine dust, and a considerable quantity can be dealt with rapidly and effectively by means of hand bellows, sulphurator, etc.

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* Speyer, E. R., Rept. of Entomologist, 8th Ann. Rept., 1922, Expt. & Res. Sta., Cheshunt. (Rev. Appl. Entomol, XI. A, p. 47, July, 1923.)

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"SCORCH" OR GLOEOSPORIUM DISEASE OF RED CLOVER.

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OWING to the autumn and winter of 1922 in the South-East of England having been damp and unusually mild, severe outbreaks of the disease known as stem rot or clover sickness, caused by the fungus *Sclerotinia trifoliorum*, became widespread through numerous crops of red clover. As a result of this attack, many fields of red clover by the spring of 1923 were reduced to such a patchy condition that it was an open question as to whether they should come under the plough; frosts and dry weather, however, prevented further damage by the fungus and the majority of thin " plants " produced, by the middle of May, a promising growth.

By this time, however, a further trouble had arisen and complaints were received, up to the time of cutting in mid-June, that the crop was suffering from a disease of a very different nature which resulted in blackening and breaking of the stems and withering of the leaves (Fig. 1).

Such damage resulted that in the majority of cases fresh stems from the crown, which should normally provide the second cut, had grown up prematurely to replace the brown stems and brittle leaves of the first cut, and the two were mown together in June.

The growth of fresh green stems and leaves at the time of cutting gave the impression that the crop had partly recovered, but it is important to realise that substitution of diseased stems by fresh growth played an important part in the apparent recovery, and though the bulk for hay had improved, the individual plants themselves were no more healthy and the second cut suffered accordingly. It has been found in other cases that the second cut may be attacked more heavily than the first.

Examination of affected plants showed the presence of a fungus agreeing closely with *Gloeosporium caulivorum*, Kirch.

The disease, also called "Anthracnose," has been investigated in this country by Miss Sampson and other workers* and has been described on the Continent and in America where it is apparently more harmful. It was mentioned by the Ministry† as occurring in 1920, and was described as "a usually scarce disease." It was first recorded by Mr. F. R. Petherbridge near Cambridge in 1920, and one crop in that year was known to have been ploughed up after the first cut had been taken. In certain districts in Kent the effects had become so prominent in the early summer of 1923, and the cause remained so inconspicuous, that as a result inquiries were made by farmers. It seems therefore desirable that the present disease should be described in order that the symptoms may be generally recognised.

Appearance in the Field.—Throughout the field and particularly in patches, it is noticeable that the upright stems and leaf stalks of the clover are marked with narrow, dry depressions, varying in length from ⅛ in. to 3 in. or more, having black margins and lighter coloured centres.

The depressions are either quite shallow, or more frequently a portion of the stem on one side is destroyed and the lesion consequently forms an oblong pit which penetrates to the pith or hollow centre of the stalk; the sides, when dry, tend to roll inwards and so cause the lesion to open slightly. The cavities thus made in the side of the stem might, from their appearance, well be caused by slugs, which are usually plentiful in clover leys, and in some cases the damage was actually attributed to them.

Around the margins of the lesions, and within the cavities, small white pustules of the fungus *Gloeosporium* can be seen with a lens (Fig. 2), but these are at all times very inconspicuous, and are most evident under moist conditions. The fungus, by penetrating the tissues, causes the lesion to increase; a part of the stem is thus destroyed on one side or it may be completely girdled by a more shallow depression and the stalk consequently falls over, causing the death of all leaves and shoots above that point. Similarly the leaf-stalk alone may be attacked and the leaf dies.

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* Sampson, K. "Red Clover: Investigations on Anthracnose due to *Gloeosporium caulivorum*," in *Preliminary Investigations with Herbage Plants*, Series H. No. 1, p. 83, Aberystwyth, 1922. Stapledon, R. G. "Plant Breeding Work at Aberystwyth," *Journal of the Ministry of Agriculture*, XXVII. 7. p. 630, Oct. 1920.

† Ministry of Agriculture. "Report on the Occurrence of Fungus, Bacterial and allied diseases on Crops in England and Wales for the year 1920–1921," p. 44.

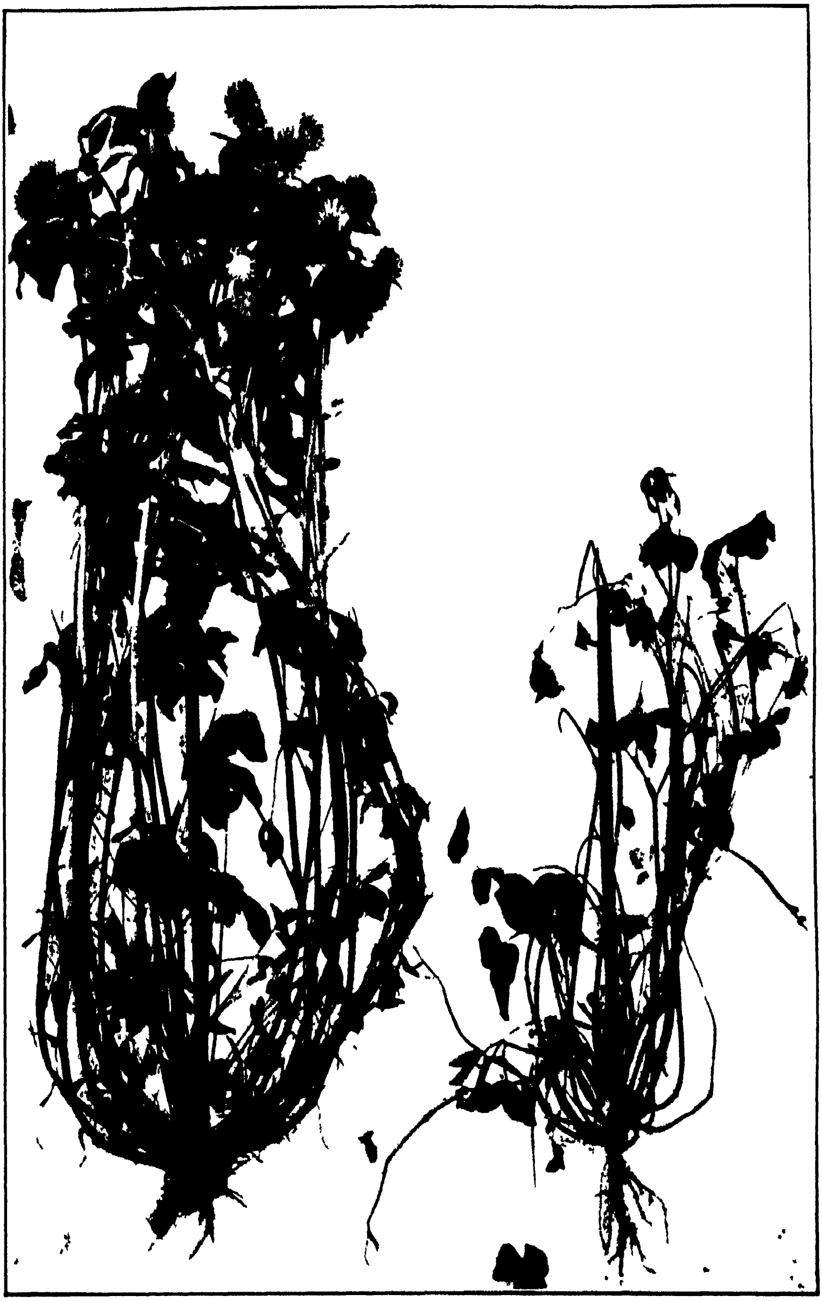

FIG. 1. *Left*. Red Clover plant free from Gloeosporium disease. Total length, 38 in.

Right. Red Clover plant attacked by *Gloeosporium caulivorum*. Total length, 24 in. Fresh green stems and leaves arising from the crown can be distinguished in the centre of the plant. These serve to replace the broken stems and withered leaves which are characteristic of the disease.

(Photographed 22nd June, 1923, at the time of cutting.)

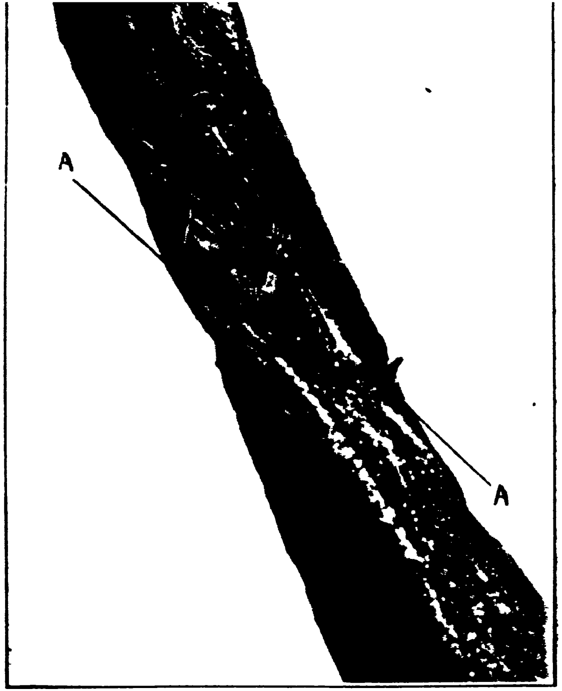

FIG. 2.—Part of a stem of Red Clover showing white pustules of *Gloeosporium caulivorum* in lesions at A, A. (× 10)

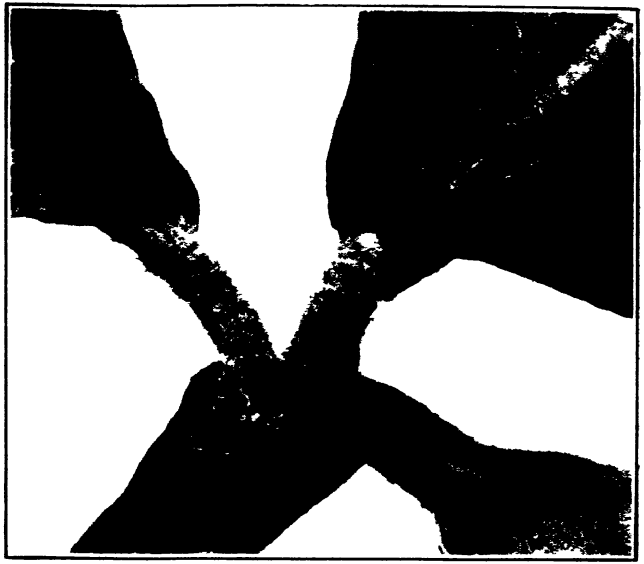

FIG. 3.—Stalks of the three leaflets of a leaf of Red Clover. Two are attacked by the fungus *Gloeosporium caulivorum*, and the third is free from disease. (× 10)

Occasionally the three short stalks of the leaflets of one leaf are infected, with the same result (Fig. 3). The white pustules of the fungus which appear on the lesions, produce masses of minute spores* which may be carried by insects, wind or rain, to cause fresh infection in other parts. It is possible that infection of the leaflet stalks, as shown in Fig. 3, may be materially assisted by moisture. Water from the leaflet blades, possibly carrying with it spores of the fungus, often being held on these stalks in the form of a drop.

Stems and leaves which are killed become so withered, dry and brittle that much leaf is lost, and, as a result, the hay is of poor quality. The clover field, as a whole, appears as though scorched. As described above, fresh growth from the crown may replace some of the loss, and in the instances observed in June, 1923, this second growth was little attacked. As illustrating the severity of the original outbreak, in one case a farmer described his first cut as consisting largely of the second.

Resistance to the Disease.—It has been noticed this year, in six small trial plots of red clover grown side by side at Wye, that English broad red was strongly attacked, but Chilian and English so-called cowgrass and English late-flowering red to a less extent. "Perennialised broad red" was only slightly attacked and on the Danish strain "Hersnap" the lesions were comparatively rare and no broken stems were found. The difference in intensity of attack was most noticeable, particularly because the Hersnap plot was adjoining the English broad red, and though the tall stems of both became intermingled, the Danish strain remained remarkably free from disease.

When examining diseased crops on the farm, it was noticed that individual plants occurred which were free from disease, though these were growing in the midst of others strongly attacked. The plants shown in Fig. 1 were growing side by side in a clover ley; that on the left was entirely free from *Gloeosporium* disease.† The above facts appear to indicate that there is definite variation in susceptibility shown by red clovers, and that varying intensity of attack is not due merely to differences in external conditions.

The first occurrence of the disease, however, may be affected by external conditions, since it is considered possible that spores of the fungus may adhere to the clover seed.*

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* The spores were colourless, curved and unicellular, measuring 10–30$\mu \times$ 4–5μ.

† Another disease, Leaf Spot, caused by *Pseudopeziza trifolii*, was present in abundance on this plant. The characteristic marks on the leaves can be observed in the photograph.

Similar variation in susceptibility to *Gloeosporium* shown by red clovers has been described by Miss Sampson,† the late-flowering reds being found relatively free from disease.

Since it is impossible to counteract the fungus when in a grown crop of red clover, it seems that the most promising method of dealing with this troublesome disease consists in selecting resistant strains in so far as the requirements of the farm will permit, but it must be remembered that weather conditions probably determine the presence or absence of this disease in any particular season.

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STOCKBRIDGE SHEEP FAIR.

A. Russell-Smith.

Stockbridge Sheep Fair, as the Hampshire saying goes, is always the best, or the worst, of the fairs in the year. It comes first after the lambing season, and the prices ruling reflect the forecasts of the market conditions of the coming year that have been formed by both the flock masters and the buyers. At subsequent fairs those forecasts have been tested and modified in the light of actual prices, but the first fair of the year is likely to be, out and out, either a seller's or a buyer's market.

The fair owes its origin to a grant made by Henry III in 1221 to William de Briwere, the then Lord of the Borough of Stockbridge and of the manor of Whit Somborne. It was to be held on the Feast of the Apostles Peter and Paul, and on the Vigil and morrow of that Feast. The Vigil of the Feast now falls on the 28th June, but before the Calendar was altered in 1752 it fell on what is now the 10th July. As the lambs could not be ready by the altered date Stockbridge has always kept to the old style and opens its fair on the 10th July.

In 1361 the Borough and Manor passed into the hands of John of Gaunt, who had married a descendant of the Briwere family, and from then until 1824 they were held by the Duchy of Lancaster. So far as the records show the fair has been held yearly since its original grant, and it has played an important part in the sheep breeding industry. It has brought the flock masters in the Down country, of which Stockbridge is the natural centre, into direct contact with the actual buyers of Down sheep from all over the country; and it has done this by offering a large selection in both numbers and quality. Of recent years there has been a falling off in numbers, in part attributable to the growth of frequent auction sales, but in the main to the disastrous reduction in the sheep population on the Downs which resulted from over-selling during the War.

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* Fulton, H. R. *Pennsylvania Station Report*, p. 249. 1912. Hegyi, Dezso, in *Mezögazdasagi Szemle*, year XXXIII, No 2. pp. 55—58. Budapest, 1915. Abstract in *Monthly Bulletin of Agric. Intell. and Plant Diseases.* Year VI, No. 4. 1915.

† Sampson, K. *loc cit.*

The first influence is a continuing one. Frequent small sales at local centres have their conveniences, but there are men of great experience amongst the flock masters who regard them as fatal to the best interests of the breeders, and of but doubtful benefit to the ultimate buyers. Such sales do not offer a sufficient selection in either numbers or quality to make it worth the while of the big buyers to attend, and, therefore, the sheep are generally picked up by the smaller men to sell again at a profit. The result is that at the auction sales the middleman too often makes the prices, and the breeder and the ultimate buyer have to bear between them, as best they may, the middleman's profits.

The second influence that has reacted to the prejudice of the fair, is happily passing. The sheep population of the Downs is increasing as the truth is being driven home that in the Down country it is impossible to grow wheat without sheep. No artificial fertilisers can ever do the work that is done so thoroughly by the "golden hoof." It must take time to re-establish the flocks that were so seriously reduced during the War, but a start has been made.

It was in these circumstances that a meeting of flock masters and others interested in Hampshire Down sheep, held in Stockbridge in February, 1923, resolved:—

1. That it is in the interest of the neighbourhood that the early sales of sheep and lambs should be concentrated at the Stockbridge Sheep Fair.
2. That to maintain quality, it is desirable that prizes be offered at such fair.

The meeting appointed a Committee of representative local farmers to make these resolutions effective.

As the result of the efforts of this Committee, the fair held on the 10th July last showed a marked improvement on those of recent years. Upwards of 2,600 sheep and lambs were penned, or more than double the number offered in 1921 and 1922, but still far below those of pre-War times. There was keen competition for the prizes, which, to the value of £47, were given by well-known flock masters and others in the neighbourhood for the best pens of pure-bred regular draft ewes, two-tooth ewes, wether lambs, cross-bred wether lambs, pure-bred ewe lambs and cross-bred ewe lambs, and a special prize for the largest penner. In each class there were prizes for the shepherds as well as the breeders. It was possible for any breeder to compete in the classes mentioned, provided he penned his exhibit in the proportion of 20 to every 100 ewes in his flock, nor was it incumbent on him to dispose of his two-tooth ewes or ewe lambs, which he might send, as several did, for competition only. In other respects the ancient character of the fair was maintained, and it was open to all who had sheep to dispose of. One interesting feature worth recording was the encouragement given by the present Lord of the Manor in formally declaring the fair open, accompanied by his bailiff bearing the historic silver mace of the town of Stockbridge.

Flock masters feel that a good start has been made towards re-establishing the usefulness of the fair, and are confident that if the buyers of Hampshire Downs will have a little patience, and in the meantime continue their support, Stockbridge will be able in the near future to offer again a full supply of sheep of the best quality. If this can be done then the fair will fulfil the purpose it has served since it was created 702 years ago: it will enable the breeders in the district, as a whole to get into direct contact with the buyers on the market wherever they may be, it will broaden out the chances of business by offering a bigger selection than can be found at the local sales, and it will help in avoiding the cost of the middleman.

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CO-OPERATIVE MARKETING BY SMALL PRODUCERS.

The advantages of co-operation are now so well understood that it is unnecessary to dwell on them here. Even the largest and most powerful interests find it desirable still further to strengthen their position by combination, and if the small producer is to achieve any useful result it is clear that it can be done only by working in conjunction with and not in opposition to his or her neighbours. The advantages of co-operative working, therefore, are taken for granted. The question is how best to apply the principle to the problem of the sale of produce. The following notes were originally drawn up for the guidance of Women's Institutes by the National Federation of Women's Institutes, but the principles are equally applicable to any small society undertaking marketing.

The kinds of produce to be considered will usually be fruit, potatoes, vegetables, eggs, poultry and rabbits, with butter and possibly cream and small cheese in some counties. In many parts of England there are now in existence substantial agricultural co-operative societies which provide the farmers with their feeding stuffs, fertilisers, seeds, and other requirements. Though the sale of farm produce is now receiving more attention, much less has been done on that side by the large societies, and it is suggested that small societies could usefully strike out a line for themselves, namely, in endeavouring to supply the smaller towns. Covent Garden and the great industrial towns are and must be catered for by the large grower. Mass consumption demands mass production and it will not pay to place on rail for transport over long distances small mixed lots which will have to compete with the large consignments of high-grade well-packed produce sent forward by the larger growers.

The Opportunity of the Small Producer.—Many small country places are much worse provided for than the great towns, and it is a striking fact that much of the produce which is seen in the shops in the smaller towns has been obtained from Covent Garden. Here, then, would seem to be at least one opening for the small producer.

The collection of the produce, its conveyance to the point of consumption and the method of selling will all require to be carefully thought out. Conditions vary so widely in different localities that it is hardly possible to do more than throw out some general suggestions and hints, leaving to a committee on the spot to work out details.

Studying the Market.—The first thing to be done is to decide which market is to be supplied, then to study what it needs. There is in this country—and it applies to large producers as well as to small—too great a disposition to grow *something* and to hope that when it is ready it will be wanted. A better plan is to consider what will probably be required by the public and the season's demand and to grow that, and particularly to grow what is likely to be in short supply.

Next, sellers must be taught the necessity of packing attractively, and as far as possible in accordance with best trade custom. Senders should be taught to visualise their produce after it has reached the point of sale, and to consider what its condition will be by then.

A difficulty will be the number of different varieties of certain things. In the case of co-operative marketing societies receiving produce from many individuals this difficulty is bound to remain, though even here some improvement can probably be effected. If the society can supply seeds and seed potatoes, which may be obtained from the nearest farmers' co-operative supply society, it can then specialise on a few only of the best varieties, and each member can be encouraged to grow as few sorts of each crop as possible.

Collection and Delivery.—It can be arranged either for members to bring in their produce to one centre or for the marketing society to collect it. In the first case neighbours can co-operate. In the second a sufficient charge for collection must be made to cover the cost. In one Women's Institute, at Watton, Herts, the plan is for the members to bring their produce to a centre in the village, where it is all picked up by a motor lorry and conveyed for sale to the market town (Hertford), five miles distant, a charge being made to cover this service.

Methods of Sale.—Two methods are open to marketing societies. They may either :—(*a*) Act as agent or salesman, charging a commission on the produce sold to cover expenses, or (*b*) arrange for the marketing committee to buy the produce itself for resale at a profit.

The second method involves considerable risk. In the first place if the marketing committee are not both experienced buyers and judges of demand they may be left with the goods on their hands. Secondly, to be successful they must maintain the right of rejecting unsuitable produce, and the exercise of this right may offend the members who wish to dispose of their surplus produce, and so kill the marketing scheme at the outset.

It should be realised that, where any business is entered into which involves liabilities on a considerable scale, *a registered society should be formed to deal with it.* An institute or club as such should not undertake it.

A stall may be rented in the market for the disposal of the goods, or more permanent premises may be taken, but care should be exercised that the cost is not too great for the amount of trade expected. Occasionally it is possible to make an agreement with the auctioneer in the market by which all the produce is sold under the hammer.

Ways and Means.—*Committee.*—This can be either the executive committee of the club or institute, or a special marketing sub-committee. A fairly small committee is desirable for this purpose.

Workers and Wages.—It will probably not be possible to pay much in wages. Possibly in a good many cases there will be one or more members who will make this their contribution to the institute or club, and will undertake to help voluntarily. In other cases, without paying a definite salary, it may be possible to give a small honorarium to the person who bears the brunt of the work.

Capital.—Whether capital to any considerable amount is required must depend entirely on the nature of the business it is proposed to undertake. If it is run on very simple lines comparatively little may be needed, though it may even then be necessary to buy a stand and trestles for a stall, egg boxes, baskets, etc., and to arrange for transport. If this is done, a special fund for the purpose should be raised.

Where business on a large scale is contemplated it will probably be best to register a separate co-operative society and proceed to issue shares (see below).

Expenses.—The institute or club will of course aim at returning to members the best price possible for their produce. Zeal for economy must not be carried beyond the limit of sound business, and sufficient margin must be allowed to cover rather more than full working expenses. What the margin should be must depend on local circumstances, but the committee should be most careful to ascertain what are the weekly working expenses and what is the weekly turnover. They can then calculate how much must be deducted from the payments to the members so as to make ends meet and leave something over to place to a reserve fund at the end of the year.

In the case of 12 Women's Institutes with marketing schemes, three charge 2d. in the shilling to cover expenses; seven charge 1d. in the shilling; one charges 2d. on perishable goods and 1d. on non-perishable; and one charges 1d. to members and 2d. to non-members.

It is better to start with sufficient margin and then be able to reduce than to make losses at the start and perhaps wreck the scheme. Eggs can probably be handled more cheaply than more bulky produce.

Registration.—The question arises whether voluntary societies which develop into trading bodies should seek registration with limited liability under the Industrial and Provident Societies Act. Registration entails both advantages and obligations. On the one hand the liability of individuals is limited to their shareholding and rests on all the shareholders instead of resting personally with the officials and committee. On the other hand registration involves the issue of shares and the obligation and expense of a public audit.

On the whole it would seem that where marketing is undertaken on a small scale or in a simple form such as that explained under the heading *Methods of Sale* (*a*) above, registration may be deferred, but that if the business becomes large or where considerable amounts of capital and other responsibilities are involved, the registration of a separate trading society will be desirable. In the latter case the Agricultural Organisation Society will supply rules and assist with the formalities.

Accounts.—A simple system of accounts will probably suffice, but it is most important that the accounts be kept accurately and up to date. If possible the advice of a professional accountant should be sought as to the best system. A separate bank account should be opened for the produce department and all money be paid into it.

Insurance.—Buildings, stock, motor vehicles, etc., should be insured against fire and accidents. Employer's liability risk should also be covered.

Eggs.—In many country districts special interest is attached to egg production. It was suggested above that in the first place effort should be concentrated on supplying the immediate locality rather than sending produce away by rail. Eggs to some extent are an exception. They can more readily and profitably be sent away than most other produce. Even with eggs, however, there is a further consideration. For the greater part of the year new-laid eggs find a ready sale and the eggs on a market stall will often help to sell vegetables and other produce which may be less in demand. It will be advisable, therefore, to send away only surplus eggs which cannot be sold locally.

Regularity of Supply.—Irregularity of supplies is the rock on which have foundered many promising schemes for the sale of produce. The quantities of apples, eggs, cheese, etc., which come to us from overseas are shipped to a large extent by co-operative societies, but in their case it is becoming more and more the custom to bind the grower under an agreement to sell the whole of his produce through his society.

Care must of course be taken that the needs of the village are supplied first, but suppose for argument an institute or club starts a market stall in a country town. People come there to buy and will expect to find regularly what they need. It is no use providing an excess of cabbages one week and none the next, but sending instead an over supply of poultry. In that way very poor prices will be the first result, and complete failure the second. Another serious offence on the part of some producers is to sell their good quality produce themselves and send in the second-rate stuff to the society. That again will soon break up any scheme. The loyal and *continuous* support of the members is essential.

Before starting, therefore, the committee will be well advised to ask themselves these questions:—Is the right kind of produce available? Is it available in sufficient quantities? Is there reasonable certainty that regularity and continuity of supply can be maintained after the market has been started? If the reply to any of these questions is in the negative, the scheme had better be deferred until the position is more satisfactory.

A Women's Institute Marketing Society: Criccieth, Carnarvon.—As an example some notes are given below of the start and progress of a marketing society formed by the women's institute at Criccieth.

Initial Steps.—This scheme was started in June, 1916. under the direction of the Executive Committee of the Women's Institute. An initial capital of £5 was raised from among the members and, with an additional £5 voted from the general funds of the Institute and the commission on sales, proved sufficient. A market manageress was appointed at 5s. a day, but all other labour, including transport of produce from the depôt to the station, was voluntary. Duplicate receipt books were used and the Committee were responsible for checking the accounts.

The turnover during the first 14 weeks was £245, and the success of the initial venture decided the Committee to turn the Voluntary Co-operative Marketing Scheme into a registered Co-operative Society.

Further Development.—In January, 1917, a Co-operative Society was formed, affiliated to the Agricultural Organisation Society, which gave advice on general organisation. The society was registered under the Industrial and Provident Societies Act and was open to non-members and men. A large section of women's institute members joined the new society; and shares were issued, assessed on an acreage basis—holders of less than half an acre being allowed to take up one share at 2s. 6d., holders of up to 10 acres might take two shares; those with over 25 acres must have eight shares.

A piece of land was now leased from the Cambrian Railway Company and a wooden building erected to serve as a wholesale depôt. A small shop in the town was rented on a six months' tenancy to serve as the retail depôt.

The present staff consists of a part-time Secretary at £35 per annum, a Collector at £2 per week, Sales Manageress at £120 per annum, Assistant 10s. per week.

A commission of 10 per cent. is charged by the society to wholesale firms and an additional 25 per cent. is charged when selling retail to the public. Prices are fixed on the basis of local and Liverpool markets. Accounts are checked daily by the Secretary during the busy season and are presented to the Committee once a month. A public audit is made twice a year. Produce is obtained by the society from shareholders only, and includes potatoes, poultry, rabbits, eggs, fruit, vegetables, butter, and similar produce. The venture has done much to stimulate production with regard to poultry and eggs

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MAT MAKING.

Communicated by the Rural Industries Intelligence Bureau, 258, Westminster Bridge Road, London, S.E.1, where reprints can be obtained.

THE making of woollen rugs by hand on canvas is often advocated as a paying home occupation for elderly persons, invalids, disabled soldiers and others, but it is very seldom that it is found to be so in fact. The chief reasons for the popularity of the idea seem to be that very little and inexpensive equipment is needed, and that the work is easily learnt, and this is true enough; but other equally important points which are often lost sight of are that the expensive materials required and the amount of hand labour involved make these articles much too costly to be at all readily saleable at rates which will pay the maker. Consequently rug making is really more to be recommended as a hobby than as a means of livelihood. (For remarks on rug weaving see p 852.)

When we turn, however, to a consideration of the possibilities of mat making better prospects are at once disclosed. In the first place, much cheaper materials are used, and in the second, the employment of equipment of a comparatively simple and cheap kind enables the rate of working to be greatly increased, so much so that the selling prices of the product can be quite low consistently with a reasonable remuneration to the worker.

Even so. however, mat making of the kind to be described cannot invariably be recommended as a whole-time industry, mainly because the disposal of output depends largely upon retail sales and a comparatively narrow local connection. Large quantities of mats are imported from India and elsewhere for disposal to traders at prices with which the individual would find it difficult to compete. They are made in standard sizes and patterns by cheap native labour. On the other hand, the local worker's principal opportunity for getting orders from the trade will be due to the special demand, by motorists, car dealers, agents, etc., for small quantities of odd sizes and special shapes, which are very much more expensive when obtained through the usual wholesale channels, but can be produced by the small local maker with little or no greater trouble and expense than the standard sizes—and sold at better prices.

At the same time the supply at any rate of small quantities at wholesale rates to retailers in the worker's neighbourhood or nearest town, need by no means be ruled out as an impossibility, and it should be worth while canvassing them for orders as well as trying for retail sales to private houses, shop-keepers, private or public institutions, etc.

There are few articles of more extensive every-day usefulness than the common coir or fibre mat, and the possibilities of local absorption should easily be sufficient to provide an individual with at least a remunerative part-time occupation. For this reason it might be very suitable for the agricultural worker during his slack seasons. In some cases, where it seems likely that the output of a whole-time worker can be disposed of without difficulty or where special contracts can be obtained, an industry of this sort would be alone able to provide a livelihood.

The work is coarse and fairly heavy, and generally rather unsuited for invalids or disabled men, though some operations undoubtedly could be performed by them. It would depend rather on the nature of the disability. The wool and wool bordered mats entail the least physical exertion, and could be made on the loom by women or girls.

Types of Mats.—There are several different types of mats which can be made, needing varying kinds of outfit to produce. These will be briefly dealt with in order, with an example and estimate of costs in each case.

The following table should be useful—it gives the dimensions of standard mats according to the numbered sizes. The prices wholesale and retail (as at August, 1923) must be regarded as approximate only. They may vary a good deal, not only in different districts, but also, of course, according to quality and price of the materials used; and the wholesale rates would be subject to discount for cash or monthly accounts.

Standard.		Reversible.				Sinnet.				Good Quality Yarn.				Wool-bordered.			
No.	Size.	Retail.		Wholesale. Per doz		Retail.		Wholesale. Per doz.		Retail.		Wholesale. Per doz.		Retail.		Wholesale. Per doz.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
1.	24 in. x 14 in.		11	8	0	3	3	33	0	2	9	26	0	4	6	46	0
2.	27 in. x 16 in.	1	2	10	0	4	0	42	0	3	3	33	0	5	9	60	0
3.	30 in. x 18 in.	1	4	12	6	5	0	52	0	4	0	40	0	6	9	74	0
4.	33 in. x 20 in.	1	7	15	0	6	0	64	0	4	6	19	0	8	0	89	0
5.	36 in. x 22 in.	1	10	18	0	7	0	77	0	5	6	59	0	9	6	106	0
6.	39 in. x 24 in.	—		—		—		—		—		—		—		—	
7.	42 in. x 26 in.	—		—		—		—		—		—		—		—	
8.	45 in. x 28 in.	—		—		—		—		—		—		—		—	
9.	48 in. x 30 in.	—		—		—		—		—		—		—		—	
Outsizes ...		7d.—9d. per sq. ft.				1s. 9d.—2s. per sq. ft.				1s. 7d.—1s. 8d. per sq. ft. (and up to 3s. 6d. or 4s. per sq. ft. if required specially shaped).				2s. 6d. per sq. ft.			

Standard sizes above No. 5 are seldom if ever stocked, and can usually be charged for almost at the rate of "outsizes." What are called "slips" are stock sizes 12 in. wide by 27 in., 30 in. or 33 in. long.

Outsizes are mats made singly or in small quantities to a customer's special requirements, and they will be by far the most profitable kind of order for the small worker. Motor car owners often require a special shape or size to suit the foot boards or the body of their cars, and have to pay fancy prices to dealers in motor accessories for them. The worker should canvass garages near him, and car owners also, both for orders and to advertise the fact that he can supply these special articles. He may often indeed get better prices than those mentioned above for this class of work.

1. **Reversible Mats.**—These are made entirely of coarse fibre spun yarn loosely double stranded, which is sold in several grades of quality at prices from £15-£20 per ton. Assuming that the small worker bought in smaller quantities he might expect to have to pay on an average 20s. per cwt.

For appearance sake, it is usual to dye a border all round the edge, 2 to 3 in. wide in a bright colour. The cost of the dye depends rather on the colour used, but should not exceed 10s. to 12s. per lb. An exceedingly small quantity is required per mat. Half a pound of dye should be sufficient for 16 doz. mats of No 1 size, or 12 doz. of No. 2 or 10 doz. of No 3. The outfit required for making consists of a reversible mat-making frame with rod and needle, a narrow dyeing trough of sufficient length to accommodate the longest side of the largest mat intended to be made, and a knife. The total cost of these would be about £9. The operation of making these mats is very simple, and the use of the frame can be learnt in a few hours, although the speed necessary to make the work pay can only be acquired with practice. The dyeing of the border is still easier and can be done by a boy or girl. Sufficient of the dye dissolved in water is placed in the trough and kept hot. Each edge of the mat is then dipped in turn and held in the solution for 10 or 15 seconds. It is usual to dip two mats at a time. Dipping should proceed at the rate of about two mats per minute, and the mats should then be hung over a rope for an hour or two to dry.

The rate of production by an experienced worker should be about 8 to 10 sq. ft. of matting per hour.

Costs Example

1 doz. No. 2 Reversible Mats (1 ft. 4 in. × 2 ft. 3 in.)

	s.	d.
Material—		
18 lb. of yarn at 20s. per cwt. say	3	2½
Dye (½ lb. for 12 dozen)		5
Labour—		
Making—4 hours charged at 1s.	4	0
Dyeing at 100-120 per hour at 1s.		1½
Prime cost of 1 dozen mats ...	7	9

It will be seen that both wholesale and retail selling prices leave a good margin of gross profit after the worker has allowed himself 1s. an hour for his labour. This gross profit, however, has to cover overhead charges, possibly including costs of carriage on material and finished goods, time spent in calling on customers or looking for orders, etc.

2. **Sinnet or Skeleton Mats.**—The making of these mats requires but a very simple outfit, but they may not be found

always so readily saleable as other kinds, and the worker must acquire skill and rapidity in the use of the sailmakers' needle and palm.

The equipment required is a stout wooden frame (with iron plates sunk into it), a sewing palm and a few medium-sized sailmakers' needles of various shapes. The plates in the frame have holes in them to take pegs which define the corners of mats of the various sizes (Fig. 1). Total cost £3 to £3 5s.

This simple and cheap apparatus would suffice for the trained or experienced mat maker, able to calculate for himself the correct sizes of the loops, which vary for different sizes of mats. The beginner, however, would probably find this a difficult and complicated process, leading to mistakes and loss of time, and it would be better in this case to use special frames which are obtainable adapted for making one size of mat only. Greater accuracy and speed in working will result, but he will be put to more expense on his outfit in the first instance.

Prices for these special frames are :—

No. 2 size	£2 0s	No. 4 size ...	£2 10s
No. 3 ,, ...	£2 5s.	No. 5 ,, ...	£2 15s

So far as standard size mats are concerned, the use of the special frames will make the work quite simple.

Outsizes are seldom required in this type of mat, but when they are they cannot be made on the standard frames sold but pegs must be driven into the floor or table in the proper positions to suit the required size and shape. Outsizes could only be produced by a worker of sufficient skill and experience to work out correct loop sizes for himself.

Sinnet mat frames are not self supporting, but the worker will require a table to lay them on whilst using them.

The mat itself is made from a single length of plaited fibre yarn, the plait being about 1 in. wide by $\frac{3}{8}$ in. thick for No. 3 mats and above. This can be purchased ready for use at about 50s. per cwt. It is twisted or bent by hand into the open work pattern required, and stitched up where needed with stout pack thread, sewing twine or fibre yarn.

Very little training is wanted to make this simple kind of mat, but a good deal of experience will be found necessary before mats can be produced rapidly and neatly.

The size perhaps most commonly in request would be the No. 3 (30 in. × 18 in.), and an experienced worker should be able to make them at the rate of about 1 an hour.

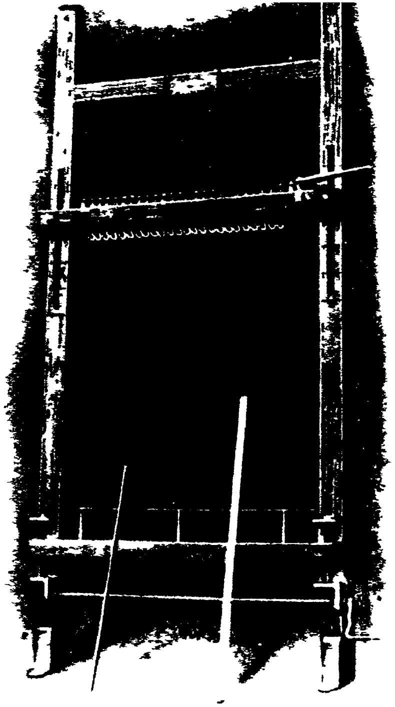

FIG. 1 A Reversible Mat Frame

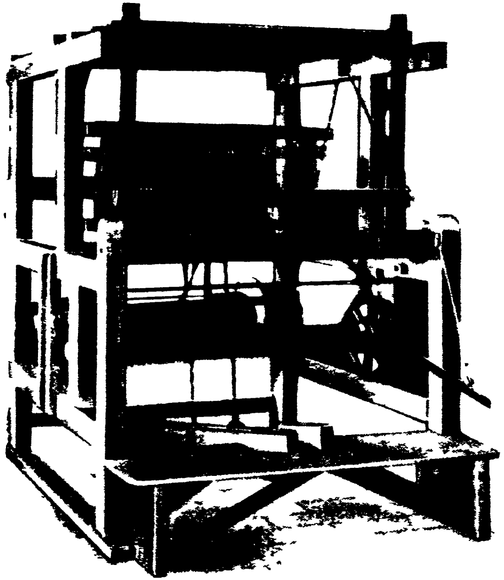

FIG. 2 Loom for making Coir and Wool Bordered Mats.

Cost.—The cost of making 1 dozen No. 3 Sinnet mats is about as follows:—

	£	s.	d.
Material—			
56 lb. of plait at 50s. per cwt.	1	5	0
Sewing twine			3
Labour—			
12 hours at 1s.		12	0
Prime cost of 1 dozen ...	£1	17	3

and this size should retail at about 5s. each.

Sinnet mats can also be dyed at the corners or along the edges if desired.

3. **Loom-Made Coir Yarn Mats.**—This type of mat should be the most easily saleable. and is also that most often required in outsizes by car owners and garages. They are made on a hand loom almost exactly similar to the old-fashioned cottage loom formerly used for weaving homespun cloth, but more heavily and stoutly built, mat making being much heavier work than cloth weaving, as the yarn is coarser and the tension of the warp higher.

The equipment required will be the loom with its harness, reed, shuttles or needles (Fig. 2); scissors, shears, cutting-out rod and knife, a simple spool winder, and needle and palm for sewing on the edge binding. The total cost of these would be about £22 to £24.

In addition, if the worker is to beam on his own warp this will require a beaming frame and a raddle at an extra cost of approximately £5. A clear floor space of about 45 ft. by 6 ft. wide will be needed for this operation. This job can of course be done out of doors, but it cannot be undertaken single handed. The worker will in fact require two assistants, one of whom may be a boy, during the operation, which, however, need not be a very frequent one as he should beam on 50 to 100 yards of warp at a time which would be sufficient for 7 or 8 doz. No. 3 size mats. If he is a spare-time worker only this should last for a month or so. The operation would take 3 to 4 hours, including resetting the loom. It is probable that the suppliers of his equipment would do this for him if required, but it will decidedly pay the worker to do it himself if possible.

Space does not admit of describing how the loom is set up for working—the method is almost exactly similar to that described in publications on hand-loom weaving; but after the warp is stretched through the harness and the reed, the way the mat itself is formed is briefly as follows :—

The yarn for the pile which the worker obtains in bales is made up into balls for convenience in working, and two strands of this yarn, taken together are worked under and over the warp threads, like a kind of coarse spiral spring, the full width of the mat. This is done very rapidly with the fingers and thumb, which must be protected with metal finger stalls from the chafing which would be caused by the very coarse fibre yarn.

The cutting-out rod consists of a long, narrow U-shaped blade of steel. This is slipped inside the loose spiral of yarn, open side upwards, above the warp threads, and the whole is then closed up by a heavy blow with the reed. The worker then inserts the blade of his knife between the two top edges of the cutting-out rod, and passes it rapidly across the whole width. This cuts all the threads at the top of the spiral and forms a double row of pile across the mat. The cutting-out rod is pulled out, another blow given with the reed, and then a couple of threads of the same material woven in to bind the pile. These intermediate or weft threads are put in with the shuttle while alternative threads of the warp are lifted or depressed by the harness, and each is driven tight with the reed. A fresh line of pile is then put in, and so on, till the loom work on the mat is completed.

The sequence of operations described above takes only a few seconds in reality, but the work is more arduous than weaving woollen cloth by hand.

On removal from the loom a length of plait ½ in. wide, say, is sewn on all round at the base of the pile holding the loose ends of the warp threads in place, and to keep the mat neat and in shape. It will be wise for the inexperienced worker at first to knot alternate loose ends of warp together and with the plait at intervals, or he may find his mats coming to pieces at the ends.

The mat is now ready for the last operation, viz., trimming. The pile as left from the cutting-out operation in the loom will be very uneven, and requires trimming flat with a pair of heavy scissors or shears—the former are best for coir and the latter for wool borders or all-wool mats. The mats should be laid on the worker's bench with one edge overhanging it and trimmed right across at this point, then moved a little further over and the process repeated until the whole is of an even thickness. The mat is prevented from slipping off the bench during this operation by placing a weight on it.

Cost of Material.—The approximate cost of the materials used is as follows:—

Coir yarn for pile, ordinary quality, about	28s. per cwt.
do. do. good quality (motor car work)	33s. to 34s.
do. for warp and weft	28s.
½-in. plait for binding	60s.

Costs Example for 1 *dozen mats, size No.* 3—

Material—	£	s.	d.
Yarn for pile, 32 lb. at 33s. per cwt.	0	9	5
Yarn for warp and weft, 8 lb. at 28s. per cwt. ...	0	2	0
Plait 2½ lb. of ½-in. at 60s. per cwt.	0	1	4

	£	s.	d.
Labour—			
Proportion of beaming on costs (⅛ say)	0	1	0
* Balling yarn from bales—½ hour.			
Making up—14 hours			
Trimming and binding—6 to 7 hours.			
Say 21 hours at 1s.	1	1	0
Prime cost of 1 dozen	£1	14	9
Each	0	2	10¾

This size should retail at 4s. each, or even more for best quality mats.

* Balling and spool winding can be done by a boy or girl.

4. **Vandyked or Straight Wool Bordered Mats.**—These are made on the loom and with practically the same equipment as in the last case, but the materials are of rather better quality. The type of mat in question has its central portion of coir or coconut fibre as before, but round the edge is a pattern worked in wool of various colours. The warp threads, or rug warp as it is termed, in this case are of a fairly fine linen thread, and it is better in this case to have the beaming on done by the maker of the loom, unless the worker is going in for manufacture on a fairly large scale or on a whole-time basis. A 200-yd. length of warp would be put on at a time, sufficient for about 14 doz. No. 3 mats. To get this done would cost about £3 15s., and would last the spare-time worker some months. The weft yarn is a soft jute cord woven in with the shuttle in the ordinary way, and the wool border is produced by using woollen yarn twisted in, but over a width of a few threads of the warp only on either side of the fibre centre, in exactly the same way as the coir fibre pile was created in the last example describing coir mat making, balls or spools of wool of the colours required being hung at the side of the loom.

These mats are not bound with plait, but at the beginning and the end a short length (about 2 in.) is woven, using a shuttle carrying a rather thinner jute yarn or binding twine. When the mat is removed from the loom these end pieces are doubled over underneath the mat at each end and sewn up.

Trimming of the faces is required as for coir mats. The wool border should be trimmed with the shears to a level below that of the fibre centre portion.

Cost of Material.—The wool used is of a much cheaper grade than that usually employed in rug making. Prices vary according to colour from about 1s. to 1s. 1d. up to 1s. 8d. per lb. Black and red are among the cheaper colours. Blues, yellows, greens, etc., are more expensive.

Cost of Making 1 *dozen No.* 3 *Wool Bordered Mats*—

	£	s.	d.
Materials—			
Wool, 10 lb. at 1s. 2½d. per lb.	0	12	0
Jute, 15 lb. at 28s. per cwt.	0	3	9
Fibre, 48 lb. at 14s. per cwt.	0	6	0
Binding, 1 lb.	0	0	4
Linen yarn, 3½ lb. at 1s. 8½d. per lb.	0	6	0
Labour—			
* Pulling off wool and teasing fibre—3 hours ...	0	1	6
Making (45 sq. ft.) 25 hours at 1s.	1	5	0
Trimming—6 hours at 1s.	0	6	0
Prime cost of 1 dozen... ...	£3	0	7
Each	0	5	0½

Retail selling price should be 6s. 6d. to 7s.

* Can be done by a boy or girl.

All Wool Mats.—With the same equipment and using the same warp as for the wool-bordered type, by replacing the coir fibre centre portion with a suitably coloured wool—bordered all-wool mats can be made in a great range and variety of patterns and colours. The cost of these would be from 40 to 60 per cent. above that of wool-bordered mats of the same size.

In this style there would be a more frequent demand for special or outsizes—they are often required by car owners to fit in a particular position, or in a shade to match existing upholstery. Another special use besides the ordinary domestic one is seating mats for pews in churches, chapels and other institutions.

Rug Weaving.—By using a better quality wool and leaving a thicker pile on the finished article, woollen rugs can also be made on the loom with very much less expenditure of time on labour than is necessary where the common hand methods are employed. While rug making, as mentioned in a previous paragraph, is not often likely to be at all a paying proposition undertaken by itself, it should be quite possible to execute on the loom occasional orders at quite a reasonable price. These rugs will always, however, be fairly expensive owing to cost of material, and consequently sales will be generally too small to provide steady work at them; and it would be unwise, even if possible, to lock up money in accumulating a stock.

Coconut Matting.—Coir, or what is often called coconut matting, as well as sacking material for making up into coal bags, sacks, etc., can also be made on the mat loom without any difficulty, but it will seldom, if ever, be possible to compete in this class of goods with the factory, to say nothing of the products of cheap native labour imported in quantities from India and elsewhere. Individual workers in a small way, therefore, are not advised to attempt it unless they are certain of being able to buy their material at specially favourable rates and to sell their output at an unusually high one.

Trimming by Machine.—In describing the process of making coir yarn and woollen mats and rugs above, we have referred to the trimming of the pile to an even thickness as being done by hand with scissors or shears. Shearing machines, either hand or power operated, can, however, be got for this purpose, and one of these would be a very useful addition to the equipment of any worker whose output is at all large; by the use of the shearing machine uniformity of thickness is automatically attained with an immense saving of time and cost of labour. These machines are rather expensive, a 30-in. hand-operated shearer costing between £70 and £80, but it should pay the worker to instal one, if he finds he can dispose of a whole-time output. Possibly in some cases, two or three workers in the same district might be able to share one, or pay for the permission to use it, if it was the property of one of them only.

Training.—For the majority of the operations described in these notes, little training is necessary beyond some instruction in the handling of the equipment or the loom—the necessary skill would follow with experience in working. One firm of manufacturers of mat-making equipment has informed us that they would be prepared to give this necessary instruction at their works to purchasers of their apparatus.

The Bureau will be glad to answer inquiries arising from these notes, and to furnish on request particulars of manufacturers and suppliers of the equipment and materials described.

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THE LONDON POULTRY MARKETS.

C. A. FLATT.

Ministry of Agriculture and Fisheries.

PROBABLY in no other market in the United Kingdom can so fine a collection of poultry be seen as the displays in the London markets of Smithfield and Leadenhall at Christmas time. These markets receive a large proportion of the turkeys and ducks from East Anglia, geese from the fen country and fowls from the fattening districts of Sussex. Although poultry of good quality come to these markets from all parts, production and marketing has reached a higher standard, and is to some extent better organised, in the areas particularly mentioned. This not only applies to the Christmas festival, but at all seasons of the year English poultry of the finest quality is to be found in the London markets. There is, however, a large quantity of English produce of inferior grade sent to London, and it has to compete with foreign supplies.

Poultry of all classes is imported to Great Britain from the Dominions and from foreign countries, and a large proportion of it comes to the London markets. Much of it is of very fine quality, and is produced to meet a definite demand and to arrive at favourable seasons.

Christmas Markets.—Some indication of the importance of our markets to the foreign producer can be gained from the following figures, which show the arrivals of British and foreign poultry and game into Smithfield Market during the month of December for the year 1922, with comparisons in the years 1921 and 1913.

	1913.	*1921.*	*1922.*
British and Irish ...	1,579 tons.	2,089 tons.	1,762 tons.
Foreign	1,302 „	553 „	1,317 „

It will be seen from these figures that the foreign producer has regained the position he held on this market before the War so far as quantity is concerned, and the figures give some idea of our Christmas bill for foreign poultry.

For the Christmas trade, turkeys, which arrive from France in considerable quantity, compare very favourably with the Norfolk turkeys, geese from Normandy and Holland are of exceptionally fine quality, while fowls from these countries also stand well in the markets. In addition, large numbers of turkeys of a lower grade come from southern Europe.

Ireland, which is included in the return with the British supplies, also sends large consignments of poultry of all classes, and a long study of the market requirements has led to great improvement in the quality and method of marketing of Irish produce.

Smithfield Market Returns.—Some further figures from the Smithfield Market Returns are given below to illustrate the steady growth of foreign competition. In these Returns the figures for British and Irish produce are not given separately, and game is included with poultry, but suitable deductions can be drawn.

	1913.	*1921.*	*1922.*
British and Irish ...	8,526 tons.	11,711 tons.	12,060 tons.
Foreign	5,230 „	1,936 „	4,393 „

Here again the recovery of the foreign supplies is notable, but in the figures for the first nine months of the present year, the increase is still further apparent. The figures for the same period of 1922 are given for comparison.

	1922. *(1st nine months.)*	*1923.* *(1st nine months.)*	*Difference.*
British and Irish ...	7,556 tons.	6,733 tons.	– 823 tons.
Foreign	2,769 „	3,695 „	+ 926 „

This increase of 926 tons in foreign consignments for the first nine months of 1923 is notable, especially in conjunction with the fact that, of the total of 4,393 tons imported in 1922, 1,317 tons were received in the month of December alone. It is also significant that this increase has mainly taken place in supplies from "Holland and other countries," whose imports have increased by 849 tons. North America shows an increase of 96 tons, and South America of 17 tons, whilst Australasian supplies have decreased by 36 tons.

There is, on the other hand, a decrease in the same period of supplies of British and Irish birds. This decrease in the nine months outweighs the gain in the 12 months of 1922 over the 1921 supplies.

Market Requirements.—Reference has already been made to the supplies for the Christmas markets. Of the poultry received at other seasons, the American box chickens of about 3 lb. weight are well favoured on the market, and French poultry meets a ready demand. A new feature on the market this year were Belgian fattened fowls almost comparable with "Surrey" fowls. They arrived late in the season, but realised within a few pence per lb. of the price paid for the latter.

The demand for poultry varies to some extent at different seasons (*see* Leaflet No. 201), but there is plenty of evidence to show that special demands can be created for any class of produce if this is of good quality. It is doubtless the poultry-keeper's first business to study the normal demands of the market and to endeavour to supply these, but if for other reasons the class of poultry produced is not such as to meet the normal requirements, there is every reason to suppose that if this particular product is put on to the market in the best possible manner, a good trade will be found.

Complaint is sometimes made of the returns received by producers for poultry sent to London salesmen. These can be accounted for in various ways.

A large quantity of the poultry received in the markets is badly finished, birds being ill fed, badly prepared and carelessly packed. Consignments are also irregular and frequently sent without sufficient warning to the salesmen.

It is probably a fact with poultry, as it is said to be with other goods, that London will absorb any class of product, but the producer of inferior quality poultry will seldom gain by sending long distances to this market. On the other hand, birds of good quality are frequently spoilt by ignorance in their preparation and in packing. In the first case the inferior birds will probably sell equally well in live condition at a local market, and in many cases these birds will be brought into better condition by the purchaser before they are eventually killed. If the producer intends to market the birds dead, he should first bring them into fit condition. Care in the details of marketing is very important; appearance adds much to the value of the product, and uniformity in the quality of the birds in a consignment is very desirable.

Where regular consignments are sent to a salesman, he is in a position to find a steady outlet for these at a satisfactory price, and in dealing with regular and large quantities of good quality produce the London markets seldom fail. Even when small consignments can only be sent at irregular intervals, if these are of good quality and the salesman is notified to expect them at a given date, satisfactory results follow. In supplying a large market like Smithfield, however, some knowledge and organisation is required. The exporter of foreign produce studies his market carefully, and directs his supplies accordingly. These supplies are also sent in larger consignments, and are consequently handled by the salesman with more economy in labour.

To effect similar results with English poultry, organisation is badly needed. In some areas the organisation has grown; the fatteners of poultry in the Heathfield and Uckfield districts and the duck fatteners in Norfolk, for instance, can be sure of their produce meeting a ready sale in the London markets. If English producers of poultry in other areas are to meet the increasing competition from abroad upon more equal terms, especially in this important market, it can only be done by a study of market requirements with a view to the adoption of better methods by the producer, and by some organisation for the regulation of supplies.

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THE IMPERIAL FRUIT SHOW, 1923.

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Ministry of Agriculture and Fisheries.

THE third Imperial Fruit Show which was held at Manchester differed considerably from all previous fruit shows. In the first place it has been wholly organised and financed by the fruit industry itself. That fact augurs well not only for future fruit shows, but for the whole future of the industry. It completely refutes the too commonly expressed view that it was impossible to combine such completely opposing interests as those of the different sections of the fruit industry.

The two primary objects of the show, viz., to improve the presentation of apples by better grading and packing, and to stimulate the demand for apples by the consumer—have been notably advanced. The idea of having with each exhibit an extra package to be shot out for the purpose of judging, left the remainder of the exhibit undisturbed—adding to the general attractiveness of the display and further demonstrating good and poor methods of packing It also provided exhibition fruit for retail sale. Visitors were able to taste apples at the stand of the Federation of British Growers and then pass on to the retail stand to purchase apples. So popular was this feature that the exhibition fruit was cleared out quite early during the show. It is the most effective move that has yet been made in stimulating the demand. and should play an important part in the organisation of future fruit shows. Arrangements might even be made whereby the public could purchase whole exhibits if the latter were priced by a valuing committee. The improvement in the general level of packing is very marked. The adoption of a standard method of box packing has greatly reduced the difficulties of newcomers in arriving at a suitable pack for different varieties and sizes. In the past, the Kent section has been well in advance of the East and the West, but now there is little to choose between the different sections. There are now more growers able to put up a sound commercial pack. with the consequence that few exhibits fall short of the exhibition standard. The display of the judges' score card in each class again attracted the lively interest of the growers attending the show. The display of cards showing the merits and uses of each variety was a useful innovation, and added materially to the propagandist value of the show. The shortness of the crop resulted in a decrease in the number of entries, but quality was well maintained notwithstanding that the growing season was remarkable for the severity of the attacks of insect and fungus pests.

Section.	Numbers in 1922.		Numbers in 1923.	
	Exhibitors.	Entries.	Exhibitors.	Entries.
British Empire—				
United Kingdom	24	39	14	34
Canada	9	17	4	5
Australia	5	6	3	3
South Africa	7	9	—	—
Overseas	13	92	6	28
Kent and Southern	47	222	17	89
East and Northern	43	187	38	109
West and Midlands	29	1 8	17	76
Irish	44	71	9	11
Channel Islands	58	85	7	8
United Kingdom*	30	58	10	19

* In addition to other classes included above.

Apples.—*British Empire Section*—Contrary to last year's experience, the best exhibits in the show were to be found in this section. This is as it should be and was no doubt in some measure due to the reduction from 20 to 10 in the number of packages required. The most striking feature of the section was the very high level attained by the great majority of the exhibits. In most cases the apples were almost perfect specimens and their condition showed that the greatest attention had been paid to every detail of picking, storing, grading and packing. It is obvious that if these details maintain such a high standard at future shows competition will be so keen that one blemished specimen may be the deciding factor in making an award. The judges had the greatest difficulty in differentiating and attention had to be directed to quite minor points of detail, such as trueness to type, before a decision in some cases could be reached.

In the dessert class, there is always keen competition between Cox's Orange Pippin and McIntosh Red. In this country we hold the view that the flavour and texture of good Cox's Orange Pippins are unapproached, but the Canadians maintain that McIntosh Red holds the premier position in this respect. No one could doubt, however, that the exhibit of McIntosh Red from British Columbia deserved first place. This was a collective exhibit from an Association of Growers who naturally had more opportunity to obtain a perfect selection of fruit. There was not a single blemished apple in the turned out package, and it is doubtful whether more perfect quality and finish for this variety could be obtained. Possibly the pack might have been considered a shade low at the ends and not absolutely solid. The second prize went to Cox's Orange Pippin from Malvern. Against the McIntosh Red these looked a little dull and russety, with some blemishes round the stalk end. Grand specimens as they were, the finding of several fruits with slight cracking near the stalks was sufficient alone to reduce the points awarded under "condition." The size (188) was about right for the variety and gives a solid pack standing up well under show conditions. If any criticism could be made, it would be that the pack looked a little flat. The third position was reached by McIntosh Red from Quebec. These were not so bright as the winning exhibit, being a little bruised and the pack rather slack. The fourth place went to Allington Pippins, also from Malvern, typical of the best of this variety, and of fine size (175); the pack was perhaps a little flat-looking as was the case with the Cox's Orange sent by this exhibitor. The fifth place was also given to Allington Pippins, this time from East Suffolk. They were well coloured, but the skin quality was not quite up to the last named. An exhibit of Worcester Pearmain, which was almost perfect, well coloured and packed, lost on condition and flavour quality. It would appear that this variety cannot hold its own in such a competition at a date so late in the year. A good exhibit of Cox's Orange Pippin put up by the Essex Growers' Branch of the Federation of British Growers won the Gilroy Challenge Cup.

In the culinary class the premier award was gained by an exhibit of Blenheim Orange from Warwickshire. These were an almost perfect sample of this variety, well packed and 96 to the box. The second place was secured by Lane's Prince Albert, sizes 80 and 88, from Malvern. They were not quite uniform in condition and quality, and the pack was a little uneven, but freedom from any form of blemish or bruise was very noteworthy. The third position was awarded to an exhibit of Lord Derby from Kent—a very good sample of the variety, but not quite up to size (88 to the box). They showed a little hail damage and the pack was rather flat in some boxes. The fourth lot were of the variety Wagener, from British Columbia. They were on the small side for a cooking apple—size 113—appeared to have been badly picked, and the pack was rather slack in three boxes. The condition and skin quality, however, were again typical of perfect selection by the British Columbia

Growers. The fifth, Charles Ross (88 and 96 to the box), were not uniform in size, shape or quality, and the pack was a little uneven. Very fine Newton Wonders from Malvern secured high points for packing, but lost points on condition and quality on account of bitter pit. Very fine Bramley Seedling from East Suffolk showed slight bitter pit and were rather slack in the pack (88 to the box). Bismarcks from Essex also showed a little bitter pit and the tight pack had bruised some apples against the ends of the box. There was evidence here of slight jamming in of the unwrapped layer.

United Kingdom Section.—Cox's Orange Pippin.—The first prize in the box class went to Herefordshire for well packed Cox's of outstanding colour and quality. The second, from Essex, were not quite such a typical colour and the pack also not quite so good—size 188. The third, from Berkshire, were of fine finish and colour, but the pack was rather slack and low. The first prize in the half-sieve class went to Devonshire for an exhibit of fine colour, finish and skin quality, a good size, uniform and well packed. These were probably the best conditioned Cox's in the show. and realised at auction 36s. per half-sieve. The second from Herefordshire were well packed and of an attractive appearance, but they were in soft condition and not uniform.

Worcester Pearmain.—The first prize lot came from Norfolk and were almost perfect in every way, receiving 95 per cent. of marks, size 188. The second from Kent were also very fine, size 175. The wrapping paper showed " tails " in the spaces. The third from Evesham were below the others in colour and condition, but were very well packed. In the class for Any Other Variety (except Cox's Orange) in half-sieves, Worcesters were awarded second and third places, being beaten only by an outstanding example of King of the Pippins.

Allington Pippin.—The first prize went to Herefordshire, Allington's of exceptional colour though rather small (216). The second, from Kent, were fine specimens, but too many sizes, most of which should have been packed 3-2. The third, from Kent, were well packed, bright fruit but rough skinned. The exhibits from the Eastern Counties were unfortunate in not being " placed " in this class as some had nearly full points for colour, finish and condition, and the pack was good. The majority also were more typical of the variety than more highly coloured fruit from Herefordshire.

Blenheim Orange.—The first prize for dessert Blenheims in boxes went to Kent for a sample of bright colour and good condition very solidly packed. The size (112 packed 2-2) is rather large for dessert, but a smaller size means a 3-2 pack with wide spaces, which is apt to shift under show conditions when the top layer must not be wrapped. The second, from Evesham, were not so bright and level in colour and the apples were not uniform in size.

Any Other Variety.—Dessert.—In boxes the first prize was won by a Herefordshire exhibit of King of the Pippins, outstanding in everything except condition. These were followed by very good Gascoyne's Scarlet from Essex, which made the same price, viz., 20s. per box, and for third place by King of the Pippins from Worcestershire. In half-sieves this class included all varieties except Cox's, and the first prize again went to Herefordshire, King of the Pippins much like the first, mentioned above.

(To be concluded.)

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NOTES ON MANURES FOR DECEMBER.

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Signs of Starvation.—The yellowish appearance of plants which are suffering from a shortage of available nitrogen, as for example in the case of winter-sown cereals in a wet cold spring, is well known. It is perhaps not so generally recognised that deficiency of potash also produces marked symptoms in such potash-loving crops as mangolds and potatoes. On Barn Field, at Rothamsted, where mangolds have been grown without potash on certain plots for many years, their appearance this year has been far from normal. The leaves became wrinkled, flabby, of a very dark green colour and tended to wither at the margins, while the leaf-stalks were much yellower than is normally the case, and the whole plant was stunted. Potatoes grown without potash showed rather similar effects. The growth was poor, the leaves were dark blue-green and dying-off was premature. Needless to say, the yield of tubers has been seriously reduced. The above effects are only seen in extreme cases, but complete omission of potash manures for a single season will often produce them in the case of potatoes.

Top-Dressing the Nurse Crop.—In a recent experiment at Rothamsted, barley undersown with red clover had been top-dressed at a time when the young seeds were just appearing through the ground. The dressings per acre were :—

(1) Superphosphate 2 cwt.
(2) Superphosphate 2 cwt. + Sulphate of Ammonia 1 cwt.
(3) Superphosphate 2 cwt. + Sulphate of Ammonia 2 cwt.

These dressings produced their usual effect on the barley crop. Superphosphate alone had little effect on the crop, which was not visibly different from barley without manure, but each addition of sulphate of ammonia gave a marked increase of grain and straw. On examining the clover plant after the barley had been removed it was noted that the dressing of superphosphate had resulted in a very good plant of seeds; the addition of 1 cwt. of sulphate of ammonia had very slightly damaged the plant, while the double dressing had been distinctly destructive. It would seem advisable in similar cases to limit the nitrogen as dressing to about 1 cwt. per acre and apply it at barley sowing. Where mixed grasses and clovers are sown the effect would not be so marked, as any loss of clover would be compensated in part by the increased growth of grass obtained from the sulphate of ammonia.

In another experiment on the influence of manuring on the malting quality of barley, one plot of barley had the sulphate of potash omitted from the complete artificial mixture while all the others received potash. The effect of the omission was not so marked in the barley crop, but the clover under the barley showed a striking depression below the level of the remaining plots which had received potash. The above effects serve to bring out the importance of considering manuring in relation to a sequence of crops rather than to the one which will actually receive the application.

Storage of Fertilisers.—Prices of artificial manures tend to vary with the season of the year, being slightly higher when they are wanted for immediate application than at other times. Quick-acting fertilisers are in most demand in March, April and May, while basic slags are more taken up in the autumn and winter months. A manure shed on the farm enables the farmer to take advantage of these small differences by buying in his supplies at a favourable price and storing them under good conditions until required. He is also independent of possible delays in delivery in the busy seasons. Dryness is the essential for a manure shed. A concrete floor for mixing purposes and wooden bins to hold the fertilisers in bulk or in bags are desirable. Most of the common fertilisers can be kept indefinitely in a dry shed without chemical changes taking place. A certain amount of atmospheric moisture may be taken up and cause lumps to be formed, but these are easily dealt with on the floor either with a wooden rammer or the back of a shovel.

Dry neutral sulphate of ammonia keeps in better condition than the ordinary grade and does not rot the bags. Lime cannot be stored in bags for any length of time. Casks of nitrate of lime should only be opened as required, as any unused excess tends to become moist when exposed to the air.

Grass Land.—The manurial requirements of pasture and meadow land may be regarded in the light of the losses of fertilising constituents which each type of grass land suffers in the ordinary course of farming. A few approximate figures are given of the losses sustained by one acre of grass land in its period of maximum productivity during the five months of summer grazing or the growing season of the first hay crop as the case may be. The losses of nitrogen, phosphate and potash are calculated as nitrate of soda, 30 per cent. superphosphate, and 12 per cent. kainit respectively.

Type of grass land.	Produce removed per acre.	Taken from the land		
		Nitrogen as Nitrate of Soda.	Phosphate as 30% Super.	Potash as Kainit.
		lb.	lb.	lb
Fattening pasture stocked with full-grown beasts.	250 lb. fattening increase.	19	10	1
Medium store land stocked with yearling stores.	200 lb. live weight increase.	37	26	3
Medium hay land.	20 cwt. hay.	205	59	282

It will be seen that the mature animals make little demand on the fertilising constituents of the pasture. The nitrogen removed would be amply provided for by the cake feeding which is commonly received at some period of the year. An application of basic slag, superphosphate or bone meal every four years would maintain the phosphate and tend to balance the added nitrogen of the cake. Potash manures would not commonly be required on such land.

Grazing with stores takes more out of the land. A phosphatic dressing (5 cwt. per acre of 40 per cent. basic slag or its equivalent) applied every 4 or 5 years will generally provide the necessary phosphate and also the nitrogen by the agency of the clover which usually appears after phosphates are applied to stiff land. If slag appears to have little effect the land may be sour (in which case the only remedy is an application of some form of chalk or lime), or potash may be deficient, when a dressing of 4 cwt. per acre of kainit in addition to the slag will often given satisfactory results.

The hay crop is exhaustive of all constituents, particularly of potash and of nitrogen, and complete and fairly generous treatment is required to maintain permanent meadow land. If dung can be spared it may be used at the rate of about 10 tons per acre every 4 years. In each intervening year a complete artificial mixture can be given consisting of 2 cwt. of superphosphate and 3 cwt. of kainit per acre in autumn, and 1 cwt. per acre of nitrate of soda, sulphate of ammonia, or nitrate of lime in spring. The above, with residues of foods fed on the aftermath, should keep up production. If the land tends to become sour, an autumn dressing of 10-15 cwt. per acre of ground lime or its equivalent (1-1½ ton) of ground limestone may be applied every 3 or 4 years, and in the year of liming the artificial mixture could be omitted.

* * * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending November 7th.*				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	...	13.15	13.10	13. 2	16.11
„ „ Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.12*	13.12*	13.12*	13.12*	(N)13. 1
„ „ „ neutral (A. 25¾ per cent.)	14.15*	14.15*	14.15*	14.15*	(N)13.11
Kainit (Pot. 12½ per cent.)	...	..	...	2. 5	3. 7
„ (Pot. 14 per cent.)	2. 7	1.18	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	...	...	...	2.10	2. 6
Potash Salts (Pot. 30 per cent.)	...	.	...	3.10	2. 4
„ „ (Pot. 20 per cent.)	...	...	...	2 5	2. 3
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 0	7. 0	7. 0	2 10
Sulphate of Potash (Pot. 48 per cent.) ...	13.10	...	10.10	10.15	4. 6
Basic Slag (T.P. 35 per cent.)	...	...	...	3 10§	2. 0
„ „ (T.P. 30 per cent.) ...	...	..	...	2.17§	1.11
„ „ (T.P. 26 per cent.)	2.13§	2. 5§	...	...	...
„ „ (T.P. 24 per cent.)	2. 9§	2. 1§	2. 0§	...	...
„ „ (T.P. 20-22 per cent.)	...	1.18§	.	2. 5§	2. 3
„ „ (T.P. 18 per cent.) ...	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.13	...	3. 7§	3. 5	1.10
„ (S.P. 30 per cent.) ...	3. 6	3. 0	3. 0§	3. 0	2. 0
Bone Meal (A. 4½. T.P. 45 per cent.) ...	9.10	8·10	9. 0	8 10	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6· 5	6.10†	6. 0	6. 5	...
Fish Guano (A. 9-10. T.P. 16-20 per cent.) ..	12.15	...	12.10	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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MONTHLY NOTES ON FEEDING STUFFS.

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Soybean Cake and Soybean Meal as a Feeding Stuff.—Soybean cake and soybean meal are two useful feeding stuffs which do not appear to be as widely used in feeding practice as their feeding value merits. Both the cake and the meal are derived from the soybean (*Glycine hispida*), being the residue left after extraction of the oil by pressing and extraction by solvents respectively. The soybean is a leguminous seed, and is chiefly cultivated in China and Japan, where it is used in many different ways as human food. Its chief characteristic is its high oil and protein content and easy digestibility. Average analyses, nutritive ratio and starch equivalent are as follows:—

	Moisture.	Protein.	Oil.	Carbohydrates.		Ash.	Nutritive. Ratio.	Starch Equiv.
				Soluble.	Fibre.			
Soybean ...	10·0	33·2	17·5	30·5	4·1	4·7	1 : 2	78·9
Soybean cake ..	14·5	42·4	7·0	25·8	5·0	5·3	1 : 1	69·1
Soybean meal ...	11·3	44·7	1·5	31·9	5·1	5·5	1 : 1	64·0

The above analyses, taken from the Ministry's Miscellaneous Publication No. 32, RATIONS FOR LIVE STOCK, enable a comparison to be made between the relative values of the bean, the cake and the meal. It will be seen that both the cake and the meal are very rich in protein, and are useful therefore as a supplement to cereal foods or any other starchy food materials. The protein, oil, and carbohydrates are very digestible, even with pigs the protein is 94 per cent. digestible, the carbohydrates are 92.4 per cent. digestible, and the woody fibre is also 60.5 per cent. digestible.

Value as a Feeding Stuff.—It would appear from the foregoing paragraphs that soybean meal and cake should prove useful feeding stuffs. Practical feeding trials bear this out. Feeding trials with the cake and meal were carried out at various agricultural institutions in Great Britain during the years 1909-1911. These trials were carried out with bullocks and dairy cows, and the soybean cake or the meal was tested against decorticated cotton cake or linseed cake. The results of such trials led to the following conclusions:—

(1) At the Midland Agricultural College feeding trials with dairy cows in 1911 showed that soybean meal was equivalent to linseed cake for dairy cows, and gave a better quality milk judged on the fat and butter tests.

(2) At the Edinburgh and East of Scotland College, feeding trials with bullocks showed that soybean cake was a healthy cattle food, and a satisfactory beef producer, and could be used with safety up to 5 lb. per head per day. Weight for weight, it was not quite equal to linseed cake as a meat producer.

(3) Dairy trials at Offerton, under the Durham County Council, showed soybean cake to be an effective substitute for decorticated cotton cake. Owing to its rich protein character it should not exceed 6 lb. per head per day.

(4) Danish experiments have shown that soybean cake and meal give a firm butter, and are quite useful for inclusion in

DESCRIPTION.	Price per Qr. s.	Price per Qr. lb.	Price per Cwt. s.	Price per Ton. £ s.	Manurial Value per Ton. £ s.	Cost of Food Value per Ton. £ s.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv. s.	Price per lb. Starch Equiv. d.
Wheat, British	—	—	9/7	9 12	0 15	8 17	71·6	2/6	1·34
Barley, British Feeding	—	—	8/6	8 10	0 12	7 18	71	2/3	1·20
„ Canadian No 4 Western	30/-	400	8/5	8 8	0 12	7 16	71	2/2	1·16
„ Danubian	30/6	400	8/6	8 10†	0 12	7 18	71	2/3	1·20
Oats, English, White	—	—	9/10	9 17	0 13	9 4	59·5	3/1	1·65
„ „ Black and Grey	—	—	8/9	8 15	0 13	8 2	59·5	2/9	1·47
„ Scotch, White	—	—	10/-	10 0	0 13	9 7	59·5	3/2	1·70
„ Canadian No. 2 Western	29/3	320	10/3	10 5	0 13	9 12	59·5	3/3	1·74
„ „ No. 3 „	28/-	„	9/10	9 17	0 13	9 4	59·5	3/1	1·65
„ „ Feed	27/6	„	9/7	9 12	0 13	8 19	59·5	3/-	1·61
„ American	24/9	„	8/8	8 13†	0 13	8 0	59·5	2/8	1·48
„ Argentine	23/9	„	8/4	8 7	0 13	7 14	59·5	2/7	1·38
Maize, Argentine	38/-	480	8/10	8 17	0 13	8 4	81	2/-	1·07
„ South African	36/9	„	8/7	8 12	0 13	7 19	81	2/-	1·07
Beans, Rangoon	—	—	7/10	7 17†	1 12	6 5	67	1/10	0·98
Peas, English, Maple	—	—	14/6	14 10	1 8	13 2	69	3/10	2·05
„ Japanese	—	—	25/6	25 10†	1 8	24 2	69	7/-	3·75
Millers' Offals :—									
Bran, British	—	—	—	7 0	1 6	5 14	45	2/6	1·34
„ Broad	—	—	—	8 0	1 6	6 14	45	3/-	1·61
Middlings, Coarse British	—	—	—	8 12	1 2	7 10	64	2/4	1·25
Pollards, Imported	—	—	—	6 10	1 7	5 3	60	—	—
Meal, Barley	—	—	—	10 2	0 12	9 10	71	2/8	1·43
„ Maize	—	—	—	10 15	0 13	10 2	81	2/6	1·34
„ „ Germ	—	—	—	9 10	0 19	8 11	85·3	2/-	1·07
„ Gluten-feed	—	—	—	8 10	1 7	7 3	75·6	1/11	1·03
„ Locust Bean	—	—	—	8 0	0 9	7 11	71·4	2/1	1·12
„ Bean	—	—	—	12 5	1 12	10 13	67	3/2	1·70
„ Fish	—	—	—	18 0	4 6	13 14	53	5/2	2·77
Linseed	—	—	—	21 17	1 11	20 6	119	3/5	1·83
„ Cake, English 9°/。	—	—	—	12 2	1 18	10 4	74	2/9	1·47
Cottonseed Cake, English 5¼°/。	—	—	—	7 10	1 14	5 16	42	2/9	1·47
„ „ Egyptian 5¼°/。	—	—	—	7 7	1 14	5 13	42	2/8	1·43
Decorticated Cotton Seed Meal 7°/。	—	—	—	12 15†	2 14	10 1	71	2/10	1·52
Coconut Cake 6°/。	—	—	—	8 12	1 10	7 2	73	1/11	1·03
Palm Kernel Cake 6°/。	—	—	—	6 2†	1 3	4 19	75	1/4	0·71
„ „ Meal 2°/。	—	—	—	5 5	1 4	4 1	71·3	1/2	0·62
Feeding Treacle	—	—	—	6 15	0 8	6 7	51	2/6	1·34
Brewers' Grains :—									
Dried Ale	—	—	—	7 5	1 4	6 1	49	2/6	1·34
„ Porter	—	—	—	6 15	1 4	5 11	49	2/3	1·20
Wet Ale	—	—	—	1 10	0 9	1 1	15	1/5	0·76
„ Porter	—	—	—	1 7	0 9	0 18	15	1/2	1·62
Malt Culms	—	—	—	7 10†	1 14	5 16	43	2/8	1·43
Soybean Cake 6°/。 Oil	—	—	—	10 15	2 13	8 2	69	2/4	1·25

At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of October and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 10s. per ton. The food value per ton is therefore £8 10s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices :—N, 13s. ; P_2O_5, 4s.; K_2O, 2s. 4d.

rations known to give a soft butter. German experiments have also shown that soybean meal is quite a useful stuff for feeding pigs. Nils Hansson, in experimenting with soybean cake, found that the use of more than 2 lb. of the cake per head caused taint to appear in the butter. French experience showed that the fresh, non-pasteurised milk from cows given soybean cake was quite sound and wholesome, but a taste resembling that of green peas developed after the milk had been kept some time. This taint was traced to the development of micro-organisms, which, however, were killed by pasteurisation, and the tainting of butter referred to by Nils Hansson was doubtless due to the same cause. Unless therefore milk is pasteurised before distribution, it is not desirable that more than 2 lb. of soybean cake per head per day should be given to the cows. Cases of poisoning from soybean meal have also occurred in this country, but investigation of the cases showed that the poisoning was not due to the soybean meal itself but to the solvent that was used for the extraction of the oil.

General Conclusions.—Soybean cake and meal are useful feeding stuffs, are readily eaten by cattle and are useful for all classes of stock. They can be used as a substitute, weight for weight, for decorticated cotton cake in all rations in which this material is included. Owing to the laxative property of the oil contained in the cake, it can safely be used as a linseed cake substitute where linseed cake is being employed for its laxative properties.

The meal or cake can be usefully included in all lamb foods, sheep foods, pig meals and cattle cake mixtures. Milch cows may be given up to 3 lb. per head per day; fattening cattle 4 lb.; horses 3 lb.; fattening sheep and pigs 1 lb.

FARM VALUES.

CROPS.	Value per Ton on Farm.	Manurial Value per Ton.	Food Value per Ton.	Starch Equivalent per 100 lb.	Value per unit S.E.	Market Value per lb. S.E.
	£ s.	£ s.	£ s		s. d.	d.
Wheat - - - - - -	7 18	0 15	7 3	71·6	2 0	1·07
Oats - - - - - -	6 12	0 13	5 19	59·5	2 0	1·07
Barley - - - - - -	7 14	0 12	7 2	71·0	2 0	1·07
Potatoes - - - - -	1 19	0 3	1 16	18·0	2 0	1·07
Swedes - - - - -	0 16	0 2	0 14	7·0	2 0	1·07
Mangolds - - - - -	0 15	0 3	0 12	6·0	2 0	1·07
Good Meadow Hay - -	4 10	0 13	3 17	31·0	2 6	1·34
Good Oat Straw - - -	2 9	0 7	2 2	17·0	2 6	1·84
Good Clover Hay - -	5 0	1 0	4 0	32·0	2 6	1·34
Vetch and Oat Silage - -	1 18	0 7	1 11	14·0	2 3	1·20

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Farm Wages and Hours in Scotland.*

I. *Wages.*—Generally speaking, few changes were made in the rates of wages agreed upon at the last Whitsun Hirings of farm workers in Scotland.

The average earnings of a married ploughman which in 1914 were about 22s. per week, now stand at 39s., *i.e.*, an increase of approximately 77 per cent., which compares favourably with the general increase in the cost of living.

The following table shows the course of wages and earnings in certain areas over the pre-war and highest levels (summer, 1921) up to the present time :—

Area.	Average Weekly Earnings.					
	Summer, 1914.		Summer, 1921.		Summer, 1923.	
	Cash	Allowances.	Cash.	Allowances	Cash.	Allowances.
Lower Clyde Valley and North Ayr ..	20/-	4/-	58/-	5/-	32/-	4/-
Fife, South Forfar and Perth Lowlands	18/-	6/-	46/-	14/-	27/-	10/
South Eastern Counties	19/-	3/-	—52—		34/-	3/6
North Eastern Counties	—	—			25/-	11/-
West Highlands	—	—	—	-	18/-	13/-

Allowances consist chiefly of a house and supplies of potatoes, milk, and oatmeal.

It is difficult to estimate the average earnings of single men. In addition to their cash wage, some of them are boarded and lodged in or near the farm-house, whilst others live in bothies and receive allowances similar to those given to married ploughmen, only less in quantity. Their earnings also vary considerably according to experience and competence. During the last two years the cash wages of single men have been subjected to greater reductions than have those of married men, and now amount to about 20s. per week plus board and lodging (valued at 14s. per week).

Only in the south-eastern counties are women usually employed in the fields, and their present earnings are roughly 22s. per week (including value of allowances). In other parts of Scotland women working on farms on other than temporary engagements generally have to perform the duties of dairymaids or kitchenmaids.

II. *Hours.*—In 1922 and again this year there was a movement amongst farmers in several areas for an increase in working hours. Proposals on the subject in East Lothian led to threats of a strike in that area, and the whole question was referred to arbitration. The decision was that the total working hours in the year as a whole should be increased by 20 for the year ending Whitsunday, 1924. A time-table was subsequently drawn up and agreed to by both parties, in which the working hours are to be reckoned from the time the horses leave the stables to the time when work in the fields stops, the hours (excluding meal-times, which are not regarded as working time) being divided as follows :—

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* From particulars given in a communication received from Sir James Wilson, K.C.S.I., which appeared in full in the *Scottish Journal of Agriculture*, Oct., 1923.

Spring and Summer 50¾ per week ...
Seed-time (4 weeks) 54 per week .. ...
Harvest (6 weeks) 58½ per week ... ...
Oct. and Nov. (6 weeks) 50¼ per week ...
Nov. to March (18 weeks) 46⅔ per week

Or an average of about 50½ hours per week for the whole year.

Provision has been made for the granting of a half-day from 12 noon on Saturdays in 42 weeks of the year.

These hours are fairly general in all areas for workers other than cattlemen and shepherds. Ploughmen, in addition to the recognised working week, have to spend an average of about 10 hours a week in the stables and in bringing the horses home, thus making their total hours of duty about 60 per week.

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Manures from Town Refuse.

THE Sheffield Salvage Department has erected, at a cost of £250,000, a complete salvage plant for dealing with town refuse and recovering from it products which can be used as manures, etc. The refuse is sifted into three grades. The middle grade, consisting principally of cinders, is used as fuel, and is sufficient to run the whole plant and leave a balance for sale. From the coarsest grade the tins, bones, rags, etc., are collected and the balance is ground and added to the finest grade. This material, which amounts to over 35,000 tons per annum, is described as "special dust fertiliser."

Fish refuse is collected separately daily and manufactured into manure, the output being about 120 tons per annum. Condemned meat is transformed into meat meal, about 25 tons per annum, while "Hairy Guano" is produced from dead cats and dogs, amounting to about 18 tons per annum. Other materials produced in smaller amounts are bone meal, blood and vegetables, yeast and vegetables, dry vegetables, and mussel grit. Further information can be obtained from The Cleansing Department, Town Hall, Sheffield.

Some unusual Weeds.

THE following notes dealing briefly with certain weeds which are not commonly serious but may on occasion prove troublesome, have been communicated by Mr. E. Wyllie Fenton, Seale Hayne Agricultural College:—

Small Rough or Beaked Hawk's Beard (*Crepis Taraxacifolia*, Thuill.) and *Larger Hawk's Beard* (*Crepis biennis*, L.), are biennial plants which are very similar and often confused. The former is by no means uncommon in certain localities although rare in others, and both are at times troublesome weeds. As the methods of dealing with them are the same they are here considered jointly. They are generally confined to waysides, waste places and railway embankments, but, like all the Compositae, they have the habit of spreading rapidly under favourable circumstances. At present, they are not often recorded as weeds of any consequence on agricultural land, but since they spread rapidly they may become a nuisance.

One field in South Devon has been overrun with these plants, and during the last two years has been a mass of yellow bloom when cut for hay. As the seeds are formed and practically ready for distribution by the time the hay is harvested, the danger, not only to the field but to neighbouring land, is obvious.

Depasturing, or early cutting of the hay, will do much to keep the plants under control, and if continued systematically, exterminate them. During the drought of the last two summers the deep rooting system has enabled these plants to more than hold their own with grasses and clovers, which normally tend, by competition, to keep them in check.

Goat's Beard (*Tragopogon pratensis*, L.) is a biennial and usually confined to banks and waysides, but occasionally wanders into agricultural areas. A case of this kind occurred in Lundy Island during the summer of 1922. It had been present on the same area previously and had not been held in check. The result was that the oat crop was found to be full of it. So plentiful was the weed that it was quite impossible to deal with it without injuring the oats. Even spraying was tried on a small scale without success, for where the Goat's Beard was affected the crop also suffered as heavily. The final result was that the weed and crop had to be harvested together. This meant, of course, that the seeds had escaped before the plants were cut, and that much trouble and probably loss would follow later. As Goat's Beard is a biennial with a thick fleshy root the only means of eradication is prevention of seeding by early cutting; by this means it can be eradicated in a few years.

One of the *Mayweeds* (*Matricaria discoidea*, L.) of comparatively recent introduction is spreading steadily. In most cases it is to be found in patches by railway sidings, canal banks, round farm buildings, and occasionally in waste areas. It seeds very readily and owing to its prostrate growth is most difficult to handle. In the majority of cases it is confined to areas of no agricultural importance, although there are cases on record where this plant has caused damage. In Cornwall a field of oats was practically ruined by this weed one year, and a similar case occurred in Herefordshire. During 1922 part of a field in South Devon was invaded and the barley yield in the area affected was much reduced.

The only known method of controlling this weed at present is deep ploughing. This is not satisfactory, as there is always the possibility that the seeds buried may in the course of agricultural operations be again brought to the surface and the damage repeated, depending largely of course on the crop.

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Acarine Disease of Bees.

ADVICE on the eradication of acarine disease from a stock of bees is given in the Ministry's Leaflet No. 395 (*Diseases of Adult Bees*). As, however, no cure for the disease has yet been discovered, the safest course, where a stock has become affected is to destroy the bees and the quilts and to disinfect the interior of the hive thoroughly by means of scorching with a painter's blow lamp. Should the latter not be available, the walls of the hive and the alighting board should be painted with paraffin and ignited In this case, when sufficient scorching has taken place, the flames can be quenched by means of a wet sack. The combs may be used again provided they have been sprayed with a suitable disinfectant and allowed to stand for two months.

The following is a simple method of killing the bees in an infected stock. A cartridge made of brown paper should be smeared with sulphur paste and placed in a smoker. The entrance to the hive should be closed by means of earth, with the exception of a small aperture, made with the finger, for the insertion of the smoker-nozzle. After dark, care having been taken that the quilts in the hive fit properly, the cartridge in the smoker should be lighted and smoke puffed into the hive until the brown paper cartridge has been consumed. The aperture should then be closed and the hive allowed to stand for half an hour. The dead bees and the quilts should then be removed and burned in a hole in the ground one yard in diameter and a foot deep. After all is consumed the hole should be filled in. If the stock has been dealt with in this manner, the spraying of the combs need not be carried out, although the combs should be allowed to stand for two months before re-use.

Note.—In Leaflet No. 395 it is stated that the Ministry will test bees for acarine disease for a nominal fee. It is regretted that it has been necessary to suspend this arrangement for the present.

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Copies of Papers for Agricultural Lecturers, Etc.

IN view of the fact that many Agricultural Lecturers, County Agricultural Organisers, etc., have only restricted facilities for the use of libraries, the Rothamsted Experimental Station has arranged to have copies taken of any papers or books in their library. Particulars of the charges for various kinds of work, which are strictly moderate, may be obtained from the Director, Rothamsted Experimental Station, Harpenden.

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AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1923.

PRODUCE OF CROPS.

Preliminary Statement showing the Estimated Total Produce and Yield per Acre of the Corn and Hay Crops in England and Wales in 1923, *with Comparisons for* 1922, *and the Average Yield per Acre of the Ten Years* 1913–22.

Crops.		Estimated Total Produce.		Acreage.		Estimated Yield per Acre.			Average of the Ten Years 1913-22.
		1923.	1922.	1923.	1922.	—	1923.	1922.	
				Acres.	*Acres.*				
Wheat -	- Tons	1,515,000	1,674,000	1,740,478	1,966,866	Cwts.	17·4	17·0	17·1
	Qrs.	*6,852,000*	*7,664,000*			*Bush.*	*31·5*	*31·2*	*31·0*
Barley -	- Tons	959,000	956,000	1,326,729	1,363,752	Cwts.	14·5	14·0	14·7
	Qrs	*5,006,000*	*5,068,000*			*Bush*	*30·2*	*29·7*	*30·8*
Oats -	- Tons	1,322,000	1,252,000	1,976,294	2,157,142	Cwts.	13·4	11·6	13·3
	Qrs.	*9,528,000*	*9,289,000*			*Bush.*	*38·6*	*34·4*	*38·2*
Mixed Corn -	Tons	83,000	83,000	115,601	123,788	Cwts.	14·4	13·3	—
	Qrs.	*518,000*	*509,000*			*Bush.*	*35·4*	*32·9*	—
Beans -	- Tons	188,000	188,000	223,422	272,021	Cwts.	16·9	13·8	15·5
	Qrs.	*824,000*	*837,000*			*Bush.*	*29·5*	*24·6*	*27·0*
Peas -	- Tons	67,000	57,000	94,670	122,717	Cwts.	14·2	9·3	13·4
	Qrs.	*301,000*	*261,000*			*Bush.*	*25·5*	*17·0*	*24·2*
Seeds Hay* -	Tons	2,828,000	1,781,000	1,814,814	1,527,646	Cwts.	31·2	22·7	28·1
Meadow Hay†	Tons	4,865,000	4,058,000	4,357,276	4,418,118	Cwts.	22·3	18·4	20·9

* Hay from Clover, Sainfoin, and Grasses under rotation. † Hay from Permanent Grass.

Autumn-sown corn was drilled under favourable conditions and came through the winter well. These crops and early spring sowings withstood the cold weather of May and June with little damage, but the later sowings of barley and oats, which were frequently sown into rough seed-beds, suffered considerably, and many crops were consequently thin and weak. Over the greater part of England the weather was fairly favourable for the harvest, and on the whole the crops were well secured. Conditions have been very different in the north-west and in Wales, where, on high farms, large areas of corn were still uncut at the middle of October, and many of the crops have been severely damaged in the stook by the continuous rains. The estimates for these districts may, therefore, require appreciable revision when harvest is completed. Wheat generally is of good quality, the grain being fairly plump, and the same may be said of winter and early-sown spring barleys and oats, but the later sowings ripened unevenly and are a poor sample.

The total production of Wheat is estimated at 1,515,000 tons, as compared with 1,674,000 tons in 1922, the whole of the reduction being due to the decline in acreage. The average yield per acre is estimated at 17·4 cwts., nearly half a cwt. per acre more than last year and one-third of a cwt. above the ten years' average. The best crops were in the eastern counties, yields being under average in most other counties. Barley is the only corn crop to give an under-average yield, the yield per acre being estimated at 14·5 cwts., or one-fourth of a cwt. below average, but half a cwt. more than in 1922. The total production of 959,000 tons, is very slightly greater than last year in spite of the reduction of 37,000 acres in the area grown. The total production of Oats, 1,322,000 tons, is 70,000 tons in excess of last year's production, as a result of the much better yield per acre, the area having been reduced by 180,000 acres. The yield per acre is estimated at 13·4 cwts., which though only a trifle above average, is 1¾ cwts. per acre better than last year, and the highest yield since 1918. Mixed Corn yielded 14·4 cwts. per acre, and the total production of 83,000 tons was the same as in 1922. The yield per acre of Beans, 16·9 cwts., is 3 cwts. per acre heavier than last year and 1½ cwts. above the decennial mean, but as a result of the reduced area the total production is much the same as in 1922, viz., 188,000 tons. Although the area of Peas was reduced by 23 per cent., the yield per acre was so much better this year that the total production exceeds that of last year by 10,000 tons or about 15 per cent. The estimated yield per acre of 14·2 cwts. compares with 9·3 cwts. in 1922 and 13·4 cwts. the ten years' average.

The yields per acre and the total production of corn are given in the table both in terms of weight and of measure. When further information is received as to the natural weight of grain of this year's crop the figures by weight may require revision.

"Seeds" sown in 1922 germinated very well, and the crop suffered little damage during the winter, so that there was a strong, thick plant in the spring. Meadow Hay was checked by the cold weather of May, but grew quickly during the warm days of the latter half of June. Over most of the country the hay was secured in good condition, but in the north and in Wales hay-making was very protracted owing to the almost continuous rains, and on hill farms in these districts large areas have never been mown and much hay has been wasted after cutting. The average yield per acre of Seeds Hay is estimated at 31·2 cwts. or 3 cwts. above average, 8½ cwts. more than last year, and the best yield since 1916. With the area also largely increased as compared with last year the total production of seeds hay, 2,828,000 tons, is over 1,000,000 tons in excess of the production in 1922. The yield per acre of

Meadow Hay, 22·3 cwts., was also above average, being about 1½ cwts. per acre above the decennial mean, and 4 cwts. per acre heavier than in 1922. The total production of 4,865,000 tons is 800,000 tons greater than last year. Taking both kinds of hay together the production is estimated at 7,693,000 tons, compared with 5,789,000 tons last year and 5,339,000 tons in 1921.

The estimates of the potato and root crops will be issued about the end of November.

PRODUCE OF HOPS.

Preliminary Statement showing the Estimated Total Production of Hops in the years 1923 *and* 1922, *with the Acreage and Estimated Average Yield per Statute Acre in each County of England in which Hops were grown; and the Average Yield per Acre of the Ten Years* 1913–1922.

Counties, &c.		Estimated Total Produce.		Acreage returned on 4th June.		Estimated Average Yield per Acre.		Average of the ten years 1913 to 1922.
		1923.	1922.	**1923.**	1922.	**1923.**	1922.	
		Cwts.	Cwts.	Acres.	Acres.	Cwts.	Cwts.	Cwts.
Kent	East ...	**37,000**	46.000	**3,535**	4.095	**10·5**	11·2	11·2
	Mid ...	**56,000**	72,000	**5,204**	5.528	**10·7**	13·1	12·2
	Weald ...	**60,000**	88.000	**6.719**	7.113	**8·9**	12·4	10·7
	Total, Kent	**153,000**	206,000	**15.458**	16.736	**9·9**	12·3	11·3
Hants		**7.900**	11,000	**1.018**	1,073	**7·8**	10·3	9·7
Surrey		**1.700**	2,200	**209**	217	**8·1**	10·1	8·2
Sussex		**18,000**	33.500	**2.266**	2.351	**8·1**	14·2	10·1
Hereford		**30,000**	30,000	**3,892**	3,915	**7·7**	7·6	8·3
Worcester ...		**18,000**	17,700	**1,951**	2.032	**9·3**	8·7	8·8
Other Counties*		**700**	500	**99**	95	**7·3**	5·2	6·6
Total ...		**229,000**	301,000	**24 893**	26,452	**9·2**	11·4	10·4

* Salop, Gloucester and Berkshire.

Note.—The estimated total production does not include the produce which might have been obtainable from areas left unpicked. The average yield per acre is calculated on the total area under the crop, whether picked or unpicked. The Hop Controller has advised each grower of the quantity he can take into control, and, as a consequence, the area left unpicked is larger than usual.

The total production is estimated at 229,000 cwts., which is 72,000 cwts. less than in 1922, and 38,000 cwts. below the average production in the 10 years 1913–22. In the south-eastern counties the yields per acre are considerably lower than those of 1922, particularly in Sussex, where the crop of the preceding year was very heavy. In Kent the yield is 2½ cwts. per acre less than in 1922, and 1½ cwts. per acre lighter than the mean of the previous ten years. Yields in the western counties are, on the whole, rather better than in 1922, the Worcestershire crop being ½ cwt. per acre heavier than that of last year, which was an average crop, and the yield in Hereford is of practically the same weight per acre as in 1922, and about ½ cwt. short of the ten-year mean.

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Foot-and-Mouth Disease.—All restrictions in connection with the outbreaks at Grimsby; Cranleigh, Surrey; Hatfield Heath, Essex; North Farnborough, Hants; West Hoathley, E. Sussex; Sprowston, Norfolk; and Whitchurch, Bristol, have now been withdrawn.

New Centres of Infection.—Since the issue of the November *Journal*, disease has been confirmed in the following new centres up to and including 16th November:—

(1)	26th Oct.	Morden, Surrey.
(2)	27th „	Paisley, Renfrew.
(3)	3rd Nov.	Dunfermline, Fifes.
(4)	6th „	Upper Wear, Riseley, Beds.
(5)	7th „	Ruskie, near Stirling, Perths.
(6)	9th Nov.	Withconsea, Yorks, E.R.
(7)	9th „	Tewkesbury, Glos.
(8)	11th „	St. Nicholas-at-Wade, Birchington, Kent.
(9)	15th „	Poulton-le-Fylde, Blackpool, Lancs.

There is no clue as to the origin of any of these outbreaks, the last of which occurred immediately after the restrictions in force in that portion of Lancashire had been withdrawn on 14th November.

Summary of Outbreaks.—(27th August—16th November.) The following table shows the number of outbreaks in each county from the commencement of the present series on 27th August.

County.	*No. of Outbreaks.*	*County.*	*No. of Outbreaks*
Bedford	1	Somerset	7
Buckingham	5	Stafford	1
Cheshire	74	Surrey	7
Denbighshire	31	Sussex E.	1
Devonshire	4	Worcester	2
Essex	5	Yorks E.R.	3
Flintshire	23	Yorks W.R.	38
Gloucestershire	10		
Hampshire	7	*Scotland.*	
Kent	2	Dumbarton	5
Lancashire	20	Fife	1
Lincs (Lindsey)	1	Lanark	4
London	1	Perth	3
Norfolk	5	Renfrew	14
Salop	27	Stirling	6
		Total	308

Slaughtered.—The numbers of animals slaughtered in connection with these outbreaks are:—Cattle, 9,714; Sheep, 8,115; Pigs, 6,867; Goats, 14; and the gross compensation is estimated at £302,000, of which it is estimated that £70,000 will be recovered by way of salvage.

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REPLIES TO CORRESPONDENTS.

Live-weight Increase of various Animals—E.D. asks (1) what weight of "Starch Equivalent," if properly balanced, is required to put on a pound of flesh when fed to the following (full-grown) animals:—*(a)* horses, *(b)* sheep, *(c)* pigs, *(d)* cattle; and (2) what live-weight increase will the above (full-grown) animals put on per day when receiving a fattening ration.

Reply *(supplied by the Animal Nutrition Institute, University of Cambridge)*: A pound of live-weight increase in the case of a full-grown steer in fresh to half-fat condition contains such an amount of protein and fat as corresponds to about 3,250 calories. A pound of starch equivalent can supply 1,071 calories, so that practically 3 lb. of starch equivalent should enable such an animal to put on about 1 lb. of live-weight increase. If the animal is in store condition, live-weight increase contains per lb. only about 2,500 calories, so that 2.3 lb. of starch equivalent should enable an animal to put on a pound of live-weight increase. If the animal is nearly fat, a pound of live-weight increase may contain as much as 4,000 calories, and it would consequently take very nearly 4 lb. of starch equivalent to make a pound of live-weight increase in such an animal. In other words the number of pounds of starch equivalent required to make a pound of live-weight increase goes up steadily as the animal improves from the store to the fat condition. The figures appear to be very much the same in the case of full-grown sheep and full-grown pigs. It is doubtful whether any similar figures exist for horses, and as the horse has not been selected for fat production, more starch equivalent would probably be required per lb. of live-weight increase. The amount of live-weight increase which is normally put on by different animals is as follows .— Sheep, rather more than 2 lb. per week ; cattle, rather more than 2 lb. per day ; pigs, from ½ to 2 lb. per day, according to age ; for horses there does not seem to be any information.

Lupins and Serradella.—F.E. asks about the cultivation of these crops for improvement of poor sandy soil.

Reply : An article on the "Value of Lupins on poor light Land," by A. W. Oldershaw, Agricultural Organiser for East Suffolk, appeared in this *Journal* for January, 1920.

Serradella is sometimes used as a crop to plough under on medium light sandy soil. It does not give so bulky a crop as lupins, nor is it so commonly used in this country. It may be sown in early spring with a nurse crop of spring oats and be ploughed under after the nurse crop is harvested, or it may be sown alone. About 40 to 60 lb. of seed per acre should be allowed. It is sometimes also sown in spring on a winter crop, wheat or rye.

Calf Feeding.—G.F. asks for information as to rearing calves from birth without giving ordinary cows' milk.

Reply : Cows' milk is essential for 2–3 weeks after birth, and calves progress much more favourably if new milk is continued for 4 weeks, and if, after whole milk is discontinued, separated milk is given until the age of 12 weeks. When milk or even separated milk is only available in small quantities the directions given on pages 11 and 12 of Leaflet No. 142 may be followed.

Valuation of Manures.—H.G., referring to Leaflet No. 72, quotes the price per ton and analysis of two compound manures, and asks how to work out the cost per unit from the price in order to compare the relative value without knowing the market prices of the different ingredients.

Reply : It is impossible to work out the value of a compound manure without knowing the current unit prices. These are given weekly in the Ministry's "Agricultural Market Report" for nitrogen, soluble phosphates and potash. The unit value of insoluble phosphates is not given ; it must be worked out from the current price of steamed bone flour, thus :—Price per ton steamed bone flour (week ending 12th October) £6 2s. 0d., less allowance 1 per cent. nitrogen (13s.) £5 9s. 0d., divided by percentage total phosphates (60)=approximately 1s. 10d.

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NOTICES OF BOOKS.

The Chemistry of Food. *A Manual for Poultry Keepers.*—(Lt.-Col. F. W. Hardy, B.A., M.B. London: National Utility Poultry Society, 1923, 47 pp., 2s.) The average poultry keeper, it is feared, does not trouble much about the chemical composition of his feeding stuffs. Usually he is quite satisfied to determine the poultry rations which he uses with little knowledge of their nutritive value, and as long as he gets results, he does not bother further. He should, however, realise that a knowledge of some of the simple scientific factors which affect him in his ordinary daily round will help him to eliminate waste and guide him in the wise choice of his poultry foods. This is where the "Manual for Poultry Keepers" by Col. Hardy, which first appeared as a series of articles in the *National Poultry Journal*, will come to his aid. It is a little book written expressly for those poultry keepers who are willing to learn a little chemistry in order to improve their knowledge of the composition and nature of poultry feeding stuffs. Not only is it clearly and concisely arranged, but its lucidity will doubtless give pleasure to many who can remember early struggles with the elements of chemistry. It contains a very useful table showing the chemical composition of the ash of the principal poultry feeding stuffs, and a brief but concise description of the chemical elements and compounds with which the poultry keeper is concerned. The mineral requirements of the fowl, the importance of vegetable acids, carbohydrates, grit, fats and oils, etc., are all dealt with. There are also illuminating and interesting sections on proteins and vitamins, and their practical application to poultry keeping. An effective diagram showing the changes which take place in food stuffs from the time they enter the body of the fowl is also given, and the book concludes with a useful and instructive section on the distinctive chemical and physical properties of various food stuffs, together with a table of analyses.

Vegetable Crops.—(Homer C. Thompson. 487 pp. London: McGraw-Hill Publishing Co., 1923. 22s. 6d.) The purpose of this book is to meet the needs of college and university teachers of vegetable gardening, bringing together results of experimental and research work, and this purpose governs the plan. It deals with principles rather than details of practice; with the science rather than the art of gardening.

Interesting definitions of terms often used with different meanings, are:—"Truck Gardening" as the growing of a special vegetable crop or a few crops in large quantities for a distant market; "Market Gardening" as the production of vegetables for a local market—more intensive, but less extensive than the former.

The book is American in conception and range, and the names of some of the vegetables treated of, sound strange to British ears; for example, Udo, Rutabaga, Skirret, Husk tomato, Okra, Martynia. There are sections for the production of canning crops, and for home gardening.

The section on soils and soil preparation is popular and elementary. A plate of one horse drawing a pair of man-guided cultivators among spinach, is an indication of labour-saving ingenuity. The advice to apply well-rotted manure, broadcast it after ploughing and thoroughly mix it with the surface soil by harrowing, strikes the cultivator in this country as strange. The records of manuring experiments are well tabulated and seem to confirm results here, that moderate dressings of stable manure along with judicious mixtures of chemical manures are economically the best.

The chapter on "Marketing" is thorough and will repay careful study. The present position concerning the standardisation of packages for vegetables by recent legislation in the United States is adequately described.

The spinach disease so destructive here is referred to as spinach blight or mosaic, and it is interesting to note that by crossing a type secured from Manchuria with types in cultivation at the Norfolk (Virginia) Experimental Station, a disease-resistant type has been evolved, called "Virginia Savoy."

Celery is gone into in great detail, doubtless on account of the fact that the crop occupied 20,000 acres in 1919, and was valued at more than nine million dollars.

An important section is devoted to potato crops, which include the Sweet Potato. The annual production of what, for distinction, is called the Irish Potato, in the United States is given as four hundred million bushels; nearly 45 per cent. of all farms, it is said, grow potatoes, and the average yield per acre is 89·3 bushels—say about 2½ tons per acre! Standard varieties and a classification of potato diseases are given in tabular form and are dealt with excellently.

It is said that Brussels sprouts have not become an important crop in the United States and this is not surprising if the illustration gives a fair specimen of the type produced. There is here surely an opening for seed export from this side. It is surprising also that sea kale is so little grown in the United States.

On the whole, the book will repay study by scientists and teachers. The illustrations are mostly good; the tables are elaborate and instructive; and there is a good bibliography—with two exceptions, transatlantic. The book gives a good idea of the immense ranges of climate and soil conditions covered by the United States of America.

Agricultural Implements.—(G. H. Purvis. 110 pp. Ernest Benn Ltd. London. (Successful Farming Series). 1923. 2s. 6d.) This handbook contains a short and simple description of the principal modern agricultural implements, and should be useful to elementary students of agricultural mechanics. An introductory chapter explains the simple mechanical terms and principles and also gives useful guidance with regard to the dissembling, lubrication, and care of implements—matters which are far too frequently neglected on the farm at the present time. The principal tillage implements are then briefly described, followed by cultivating, harvesting and barnyard machinery, dairy appliances, &c., and the book concludes with chapters on prime movers, including agricultural tractors, and the utilisation of wind, water and electrical power. The book is copiously illustrated with appropriate photographs, drawings, diagrams and sketches.

Dairy Cattle.—(James Mackintosh, N.D.A., N.D.D. London: Ernest Benn, Ltd., 1923. 1s. 6d. net. 77 pp.) The sixth and last volume of Benn's "Successful Farming Series" deals with the management of the dairy herd for the production of milk. In a simple and instructive manner the author discusses the best type of dairy cow, improvement by breeding and selection, herd management, feeding, hand and machine milking, calf rearing, and the management of dairy heifers. Written by a recognised authority, this little book can be recommended to all cow-keepers and dairy farmers.

The Biology of the Fowl.—(E. Evans, 21, Rydal St., Burley, 1923, paper backs 5s., cloth backs 7s.) Mr. Ernest Evans has prepared this work for the many poultry keepers who have a keen desire to know more of the fowl. Within the compass of 160 pages he has described the physiology of the fowl and of reproduction, the blood and circulation, respiration and ventilation, the digestive and nervous systems, eggs and incubation, and the development of the chick. There are also chapters on foods, feeding, vitamins, heredity, and poultry breeding. This little book, written in lucid style and in simple language, is a useful addition to our poultry literature, and will well repay study.

Commercial Poultry Raising.—(H. A. Roberts, 607 pp. London: Chapman and Hall, 1923, 15s. net.) This book now published in London made its appearance in the United States in 1918. The author deals in detail with the problems of the commercial producer of eggs and table fowls, giving particular attention to housing and marketing. Chapters on ducks, geese, turkeys, guinea fowls, and pigeons are included. There are over three hundred illustrations.

* * * * * *

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Sinnott, E. W.—Botany: Principles and Problems. (405 pp.) New York and London: McGraw-Hill Publishing Co., 1923, 15s. net. [58(02).]

Russell, Sir E. J.—Farm Soil and Its Improvement. (126 pp.) London: Ernest Benn, Ltd., 1923, 7s. 6d. [63.11(02); 63.16(02).]

Russell, Sir E. J.—Rothamsted and Agricultural Science. (13 pp.) London: Royal Institution of Great Britain, 1923. [37(072).]

Faton, T. H.—Vocational Education in Farming Occupations: The Part of the Public High School. (374 pp.) Philadelphia and London: J. B. Lippincott Co., 1923, 8s. 6d. net. [37(02).]

Barthel, C.—A Review of the Present Problems and Methods of Agricultural Bacteriology (116 pp.) Stockholm: Knut and Alice Wallenberg Foundation. 1923. [576.8.]

Horticulture.

Thompson, H. C.—Vegetable Crops. (487 pp.) New York and London: McGraw-Hill Publishing Co., 1923, 22s. 6d. [63.511(02).]

Plant Diseases.

Bewley, W. F.—Diseases of Glasshouse Plants. (208 pp.) London: Ernest Benn, Ltd., 1923, 12s. 6d. net. [63.23; 63.24.]

Fryer, P. J.—Successful Spraying and How to Achieve It. (154 pp.) London: Ernest Benn, Ltd., 1923, 7s. 6d. [63.294(02).]

Live Stock.

Oregon Agricultural Experiment Station.—Bulletin 198:—Fattening Lambs on Alfalfa. (16 pp.) Corvallis, 1923. [63.631: 043.]

Kent, Surrey and Sussex Farmers' Co-operative Bacon Factory, Ltd.—A Reference Work on Bacon Pigs and Their Factory. (80 pp.) Lenham, 1923, 2s. 6d. [63.64; 664.9.]

Texas Agricultural Experiment Station.—Bulletin 305:—Swine Feeding Experiments (41 pp.) Brazos County.—1923. [63.64: 043.]

Dairying.

Leitch, K. H.—Dairy Farming. (304 pp.) [Scottish Series of Junior Agricultural Textbooks.] Edinburgh: W. Green & Son, 1923, 6s. net. [63.70(02).]

Mackintosh, J.—Dairy Cattle. (77 pp.) [Successful Farming Series.] London: Ernest Benn, Ltd., 1923, 1s. 6d. net. [63.711(04).]

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W.1.

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE
Vol. XXX. No. 10.

JANUARY, 1924.

NOTES FOR THE MONTH.

Foot-and-Mouth Disease: The Ministry's Policy.

THE present policy of the Ministry in dealing with foot-and-mouth disease is the stamping-out policy, *i.e.*, the extermination of the virus of the disease by the immediate slaughter of all affected animals and of all other animals which, owing to their close contact with the former, are certain to become infected. As the virus of the disease from an affected animal can be carried long distances on the feet of other animals, or on the feet and clothes of persons, and even by birds, and may possibly be air-borne, the prompt disposal of affected stock by slaughter is considered the most effective means of eradication, particularly in an island country like our own possessing the natural protection afforded by the sea against the re-introduction of infection by direct contagion.

Exception is, however, made in the case of pedigree stock, valuable not only intrinsically but also from their Herd or Flock Book position. The local circumstances in these cases are often specially favourable to successful isolation, and this class of case presents little difficulty.

The position of Great Britain may be compared with that of certain other countries which enjoy periods of freedom, or comparative freedom, from foot-and-mouth disease, viz., Canada, Australia, New Zealand, the United States of America, Norway and Sweden. These countries, like Great Britain, either prohibit the entry of livestock or protect themselves with drastic quarantine laws against the entry of diseased animals. The first three countries have been entirely free from foot-and-mouth disease for many years. The United States and Sweden have adopted the slaughter policy and it may be assumed that the above-mentioned British Dominions and also Norway would adopt this policy if invaded by the disease.

Other countries in Europe, Asia, Africa and America deal with the disease by isolating infected stocks, regulating stock movements within their boundaries and quarantining the animals they import, or alternatively let the disease take its course without interference. Denmark and Holland periodically free themselves from the disease but become re-infected from neighbouring countries.

Comparative Cost of Slaughter and Isolation.—*Slaughter—Great Britain.*—The Ministry has adopted the policy of slaughter since 1892, and the country has since that year enjoyed considerable periods of freedom from the disease, viz., from 1895-1899, 1903-1907, 1909 and 1917. Every fresh invasion has been dealt with rapidly by slaughter, at a total cost of £943,176 in compensation for animals slaughtered during the 31 financial years ended 31st March, 1923. Estimating the total value of the animal stock of Great Britain, consisting at June, 1923, of 7,013,025 cattle, 20,598,331 sheep, and 2,796,531 pigs, at about £300,000,000, the compensation is equivalent to the payment by the State of an annual insurance premium of about £30,000, or 2½d. per £100. If the last two years (1922-23), which can justifiably be regarded as abnormal, are excluded, the average annual cost of keeping the country free from the disease by the slaughter policy was little more than £9,000.

It has been contended that the slaughter policy seriously depletes the livestock of the country. The adoption of that policy in 1922 (the worst year since 1884) involved the slaughter of 24,071 cattle, 21,831 sheep, and 9,821 pigs. These figures represent but a very small percentage of the total number of animals of each class in Great Britain, viz., cattle, 0·35 per cent. (or 35 per 10.000); sheep, 0·1 per cent. (or 1 per 1,000); and pigs, 0·36 per cent. (or 36 per 10,000).

The numbers of animals which have been slaughtered, or have been authorised to be slaugthered up to 20th December in connection with the present outbreak are 47,388 cattle, 20,747 sheep, and 24,999 pigs. The percentage relation of these figures to the livestock population is cattle, 0·67 per cent. (or 67 per 10,000); sheep, 0·1 per cent. (or 10 per 10,000); and pigs, 0·90 per cent. (or 90 per 10,000). So far, therefore, as their effect upon the livestock population is concerned, the number of animals slaughtered is negligible. It may be observed that the figures above quoted representing the livestock population in June, 1923, are, notwithstanding the adoption of the slaughter policy in 1922, the highest figures recorded for the past 4 years in the case of cattle, for the past 5 years in the case of sheep, and for the past 12 years in the case of pigs.

The *United States* suffered a severe visitation in October, 1914, after a period of five years' freedom. In this case the disease spread in three months to 210 counties in 18 separate States. As the Chicago stock-yards became infected the position appeared desperate, but the United States Government did not hesitate ruthlessly to slaughter every affected animal and succeeded eventually in clearing the country of the disease by May, 1916, at an expenditure of £1,500,000, equivalent at the present day to an expenditure in this country of not less than £2,500,000. Since the year 1916 the United States has been free from the disease.

Isolation.—*Great Britain* (1870-1884).—The annual loss from mortality and from deterioration in flesh and milk of affected animals in the countries which adopt isolation in lieu of slaughter can only be vaguely estimated. Reference to early reports concerning the disease in Great Britain shows that the losses through deaths, depreciation in affected animals, loss of young stock, loss in milk and butter, and in other necessary expenses, in the counties of Cumberland and Westmorland, for which an estimate exists during seven years preceding 1878, were not less than £43,000 per annum. If this estimate be extended to the whole of Great Britain, the annual loss through the disease at that time would be put at about £1,500,000 per annum in the lower values of that day. It may be mentioned, in passing, that after 1878 in these two counties a policy resembling our own present policy of slaughter was put into force, and seven outbreaks only of the disease occurred in the next six years. In each of these outbreaks the disease was prevented from spreading beyond the farm or premises in which it appeared, and this at a time when much disease was prevalent in the country as a whole.

Holland.—The Ministry is informed that a policy of slaughter was attempted in Holland a few years ago, but that this was abandoned when the expenditure reached £500,000. It was subsequently found that the annual loss to farmers from the disease being allowed to gain a footing through the adoption of the isolation policy reached £2,500,000.

France.—It is estimated that the losses in France, where the isolation and treatment policy is adopted, amounted in a recent year to at least £5,000,000.

Stock Movement Restrictions. — *Slaughter.* — By rapid slaughter and disinfection, the inconvenience and loss to farmers due to restrictions on movement are reduced to a minimum, as this policy enables the restrictions to be withdrawn after a comparatively short period, usually about five or six weeks in the case of an ordinary outbreak, except on the infected place itself, where the restrictions are maintained for two months, or six weeks from the completion of disinfection.

Isolation.—With the adoption of isolation it would be practically impossible, judging from Continental experience, to prevent the disease spreading and becoming endemic. Restrictions on movement and marketing of all stock within 15 miles of an outbreak would be imposed—as under the present system—and they would have to be maintained so long as active centres of the disease existed. This would mean the maintenance of restrictions for long periods over large areas. The movement of stock from the infected farm, and in some cases from adjoining farms, would have to be prohibited for probably six months. Even then, all danger of recovered animals affecting any susceptible animals with which they come in contact would not have entirely ceased.

In Switzerland all animals after recovery from an attack are branded and may not be mixed with unbranded stock for eight months.

Great Britain is more unsuitable for an isolation policy than the Continent, as in this country sheep stock greatly preponderate and these cannot be successfully isolated, as in many districts they run together in thousands on common pasture ground.

Export Trade in Pedigree Stock.—The export trade of this country in pedigree stock is a very important and valuable one. In the four years, 1913, 1919, 1920 and 1921, the average annual value of the export trade in cattle, sheep and pigs was £700,175. Foreign Governments impose restrictions on the importation of stock from Great Britain when disease exists and the export trade in 1922 was on this account reduced in value to £230,925. If disease became endemic, as it almost certainly would under a policy of isolation, the export of pedigree stock to those countries which have been our best customers would cease.

General Conclusion.—If the policy of isolation and treatment could be made effective, it is reasonable to conclude that such would have been the result in Continental countries such as France and Germany. Those countries have, however, failed to prevent the disease spreading and becoming endemic.

The abandonment of the policy of slaughter in favour of one of isolation and treatment in Great Britain would be tantamount to admitting that notwithstanding the natural protection afforded by the sea, this country must in future place itself on a level of equality with other Western European countries as regards foot-and-mouth disease. The disease could not be prevented from becoming endemic, and the losses and inconvenience to farmers and livestock traders which would result from the disease and from the operation of restrictions imposed, not only by the Central Authority, but also by the various County Authorities, would become permanent, and the internal trade of the country in stock would suffer considerably.

The average annual losses to the country might easily reach as high as £2,000,000, compared with the average annual cost of £30,000, incurred in carrying out the slaughter policy during 31 years.

Finally, this country would lose its pre-eminent position as regards the export trade in pedigree stock.

Opinion of Departmental Committee of 1922.—The Departmental Committee which enquired into the widespread outbreak of foot-and-mouth disease in 1922 stated in paragraph 100 of their Report (Cmd. 1784) dated 7th December, 1922, as follows:—"We are in agreement with the majority of the witnesses who have stated their opinion that the policy of slaughter is the correct one and should be maintained."

Relation of Question of Isolation to the Outbreaks of 1923.—The present series of outbreaks commenced at the end of August, 1923. One very disturbing feature has been the number of apparently unconnected centres of the disease established in widely separated localities, in which Scotland as well as England has been involved; another is the extraordinary rapidity with which infection has spread from farm to farm in the North Midlands Area (Cheshire, Salop, Denbighshire and Flintshire). Until the third week in November the new centres (with the exception of the Cheshire Group) were by the established method of slaughter being quickly stamped out, and no fewer than 16 of those centres no longer exist. On the 18th November, however, some pigs moved to Newcastle from premises in Scotland on which foot-and-mouth disease was discovered three days later contaminated the loading docks at Newcastle and also the markets at Newcastle and Gateshead on the 19th and 20th November. Infection was picked up in those places and taken to certain other markets and thence to numerous farms in Northumberland, Durham, Yorkshire, Derbyshire, Nottinghamshire, Staffordshire and Leicestershire. This unfortunate occurrence was the direct cause of some 160 further outbreaks and materially increased the difficulties of eradication. There is now nevertheless reason to think that all known centres of infection, except that in the Cheshire Group, are well in hand. In the latter, however, the disease continues to spread, at the date of going to press, at the rate of more than 20 fresh farms daily.

The problem has now resolved itself largely into one, firstly, of checking further spread of the disease in the Cheshire Group, and preventing its escape from that area, and, simultaneously, of securing the elimination as quickly as possible of other centres of infection still existing and also of those which may yet appear. Both of these objects would be retarded by the adoption of isolation of affected animals, which would mean the upkeep of large numbers of centres for the manufacture of fresh virus and expose the remainder of the country to the danger of re-infection. If such a procedure were applied to the Cheshire area—

(1) the area would have to be isolated from the rest of the country for many months;

(2) it would be impossible to re-stock farms now empty for an indefinite period, as the animals would almost certainly fall with the disease; and

(3) its milk and dairy products would be enormously interfered with.

* * * * * *

Warning Against Hay and Straw Used for Packing.

THE Ministry desires again to call attention to the possible risk of foot-and-mouth disease being transmitted to flocks and herds in this country by means of hay and straw used for the packing of foreign imported goods.

This question was considered by the Departmental Committee appointed by the Minister in 1912 to inquire into foot-and-mouth disease in Great Britain. In their Report, that Committee pointed out that numerous imported articles are packed in hay and straw, and that a large proportion of this packing ultimately reached the farm as manure. That Committee considered, and the Departmental Committee appointed in 1922 supported the view, that hay and straw used for packing constituted a possible medium for the introduction of disease into the country, but in view of the serious dislocation of general trade which the prohibition of its use would entail, neither Committee was prepared to recommend the issue of restrictions to that end.

All persons using such hay and straw are, however, warned of the element of danger which it contains, and of the risk of allowing it to come in contact with any animals.

Agricultural Returns, 1923.

THE Ministry's annual report on the acreage of crops and number of live stock in England and Wales in 1923 has now been published. Preliminary figures for the whole country were issued in August, see page 569 of this *Journal* for September, but the appendices to the annual report give the finally revised figures for each county.

The chief changes in cropping as compared with the previous year are discussed in the report, and a table is included showing the distribution of arable land among the different crops over a period of years. The efforts made this year to obtain data as to fruit which will afford a better basis for estimating the total production are dealt with at length. The returns of the number of orchard trees show that there are nearly 22,000,000 fruit trees on agricultural holdings in England and Wales.

In the report on live stock a table is included which shows that over a long period of years the supply of cattle for beef production has been practically stationary, the increase in the total number of cattle being almost wholly due to the increase in milk production. A similar table as regards sheep indicates that whereas in Wales the number of sheep per 1,000 acres has increased in the past forty years, and in the north and north-west of England there has been no great decline, in the eastern counties there were only 173 sheep and lambs per 1,000 acres in June, 1923, against 561 in 1875-79.

Returns of the number of agricultural workers employed on 4th June, 1923, are also included in the report. These show that between June, 1921, and June, 1923, the number of regular workers on agricultural holdings declined by 59,952 or nearly 9 per cent

The Report, which forms Part I of the Agricultural Statistics, 1923, is published by H.M. Stationery Office, and may be purchased through any bookseller or from the Stationery Office Sale Office, Kingsway, W.C.2, price 1s. 6d.

* * * * * *

Closing of the Cattle Testing Station, Pirbright, Surrey.

THE Ministry desires to announce that the Cattle Testing Station at Pirbright, Surrey, will be closed as from the 1st March, 1924.

Hitherto exporters of cattle to South Africa have been required under the regulations of the Government of the Union of South Africa to place their animals at the Pirbright Station for 28 days quarantine prior to the application of the tuberculin test immediately before exportation. In view of the closing of the Station, no more animals will be received there. Animals already at the Station will complete their quarantine and testing there before export, and will not be tested again on arrival at South Africa, provided that they are accompanied by the usual certificate from the Ministry that they have passed the tuberculin test at the Station.

In regard to the cattle not admitted to the Pirbright Station, it is observed that under the present regulations of the Union of South Africa cattle imported from countries from which importation is not prohibited and in respect of which no arrangement has been made for quarantine and test at a Government Testing Station are required to be quarantined for at least 28 days and subjected to the tuberculin test at the port of entry. Any animals which react to the test may be destroyed without compensation, or the owner may be required to re-export them to the country of origin at his own expense.

* * * * * *

Report on Animal Diseases.

THE Annual Report on Animal Diseases in 1922, by Sir Stewart Stockman, the Chief Veterinary Officer of the Ministry, has now been published. It is of special interest on account of the history which it gives of the outbreak of foot-and-mouth disease in 1922, the largest and most widespread since 1884. The outbreak commenced in January, 1922, at Hull and Newcastle, and spread in the course of six months to 1,125 premises in 30 counties in England, 1 in Wales, and 13 in Scotland. Charts are included which show the progress of the disease, and the chain of infection of markets in January to which its spread was mainly attributable.

The report also includes a *résumé* of the general conclusions of the Departmental Committee appointed under the chairmanship of the Rt. Hon. E. G. Pretyman, M.P., to inquire into the origin and circumstances of the outbreak, and the policy and procedure pursued in connection therewith, and to report whether any alteration of the methods of administrative control or of the existing law is necessary or desirable.

As regards other animal diseases, the report shows that continued progress was made towards the eradication of glanders, that there was an appreciable decrease in the number of outbreaks of sheep scab, and that only half the number of cases of parasitic mange in horses occurred during 1922, as compared with the previous year. On the other hand, outbreaks of swine fever and anthrax showed an increase.

The second part of the report is occupied by an account of the measures taken to prevent the introduction of disease from abroad, and to protect animals from avoidable suffering in transit by land and sea, notably in connection with the exportation of horses to the Continent. It includes a summary of the events of the year leading up to the passing of the Importation of Animals Act of December, 1922, which permitted the importation of Canadian store cattle.

The report concludes with a record of the work at the Government Cattle Testing Station, Pirbright, and of the diagnostic and other business transacted at the Veterinary Laboratory, New Haw, Weybridge. Copies are obtainable through any bookseller, or directly from H.M. Stationery Office, Kingsway, W.C.2 (or Manchester, Edinburgh, and Cardiff), price 3s. 6d. net, post free 3s. 7½d.

* * * * * *

The Government Pavilion at the British Empire Exhibition, 1924.

The following note describing the Government Pavilion at the British Empire Exhibition has been issued by the Exhibition Authorities. The Pavilion will include an Agricultural Section in regard to which information will be given in subsequent issues of the *Journal*.

"For the British Empire Exhibition, which will open at Wembley in April next, the British Government is erecting a Pavilion of appropriate dignity of structure and design. The Royal Suite for the use of the King and Queen will overlook the portico, which will be supported by columns thirty-two feet high, and will be guarded by six massive lions, symbolical of the might and dignity of the Empire. The navy, army and air force are organising impressive displays, and many important aspects of Empire communication, trade, and settlement, and Imperial economic development will be presented. On a water stage seventy feet wide, which, by an ingenious mechanical arrangement, can be converted in a few minutes into an ordinary stage for other displays, certain historical episodes on sea and land and in the air will be realistically reproduced. The Air Force exhibition of models will be supplemented by exhibits of actual aeroplanes and aircraft in an aerodrome easily accessible from the Exhibition grounds. In the Central Court of Honour of the Pavilion a gigantic model relief map of the world will show by changing lights the growth and extent of the Empire, its resources, development and population. The home country's productive capacity in relation to its ability to manufacture goods for export, and the importance of British overseas trade, will also be illustrated by a large scale model of Great Britain and Ireland. In an annexe there will be a cinema theatre where films of Imperial interest will be in continuous display. The Royal Mint. which will show a complete set of coins of the Empire and of British war medals, will strike special commemorative plaques. The Post Office exhibit will illustrate the most up-to-date methods in the organisation of postal services as well as the recent developments in telegraphy, telephony and wireless communication. Medical and scientific research will be illustrated, and an important exhibit will be that relating to tropical health and hygiene. The Empire's contribution to the progress of modern science, both pure and applied, will be shown by the Royal Society in a manner likely to appeal to the popular imagination. The Ministry of Health, Ministry of Agriculture, Mines Department, Imperial Mineral Resources Bureau, Royal Botanic Gardens at Kew, and the Geological and Ordnance Survey will all be attractively represented."

* * * * * *

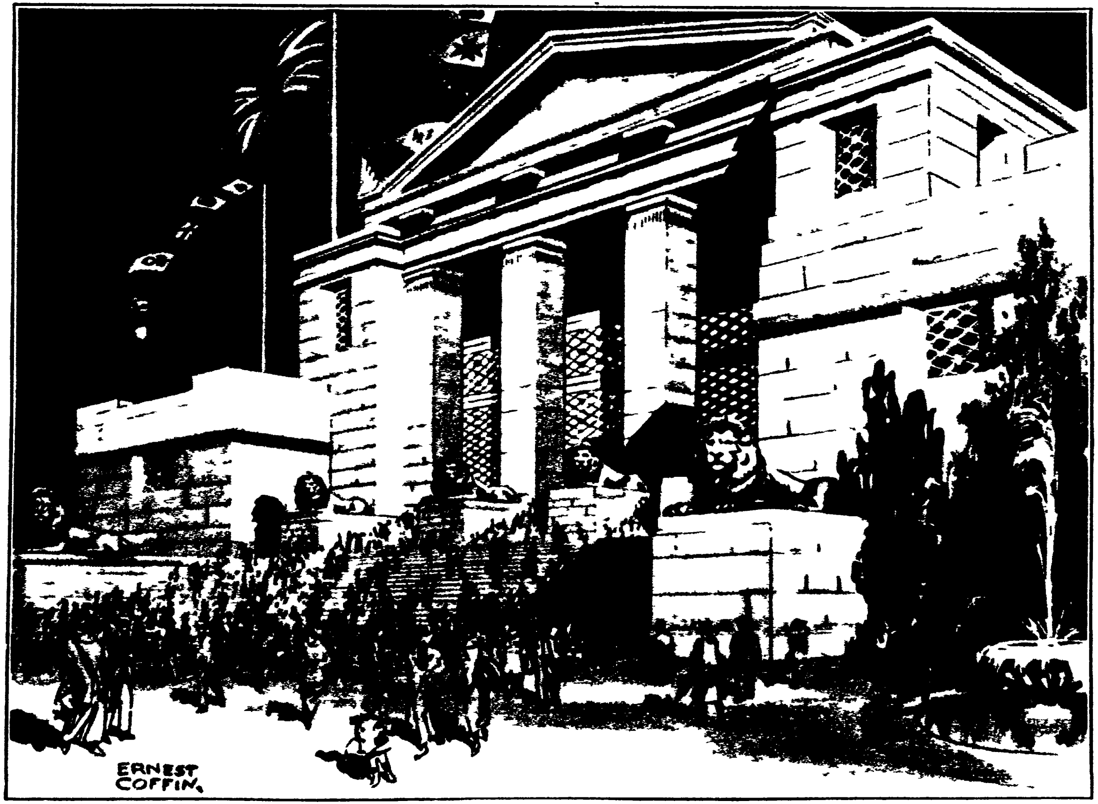
Conciliation Committees in Agriculture.

THE Denbigh and Flint Committee has agreed that wages shall remain unchanged until 30th April next. The rates are 33s. for 61 hours for adult horsemen and stockmen, and 27s. 1d. for 50 hours for other adult male workers. Provision is also made in the agreement for payment at proportionate rates to certain juvenile workers, and for a weekly half-holiday whenever possible.

A further wages agreement has been reached by the Carnarvonshire Committee. The terms, which are to remain in force until 13th May next, are as follows for male workers over 20 years of age:—

Special Class Workers living out.—35s. for a week of 61 hours (to include the Sunday feeding and cleaning of stock). *Special Class Workers boarded and lodged on farm.*—33s. 6d. for 61 hours, the deduction in respect of the provision of board and lodging being reckoned at 14s. for 7 days and 12s. for 6 days.

Other Workers.—30s. for a 50-hour week.



Government Pavilion at the British Empire Exhibition (see p. 889).

CO-OPERATIVE MARKETING IN THE UNITED STATES OF AMERICA.

Recent developments in co-operative marketing in the United States seem to mark an epoch in agricultural organisation. As in other countries the movement has passed through an experimental stage, a period of trial and error, out of which it now seems to have emerged with certain definite principles which are the direct result of practical experience. During the past few years, the progress has been most striking, and it is hardly too much to say that co-operative marketing is at the present moment the dominant movement in American agriculture.

Co-operative marketing in the United States started with dairy produce in the early part of the 19th century. It passed through a phase when it formed part of what was known as the "Grange Movement" founded in 1867, and the period between that year and 1880 saw the rise and fall of innumerable co-operative enterprises engaged in the marketing of grain, cotton, livestock, tobacco, wool and other produce. A failure to meet the real economic needs of agriculture, combined with radical mismanagement, brought this movement to sudden collapse, just as in Europe the application of the "Rochdale" principles to the marketing of farm produce—*i e.*, the marketing of a large number of agricultural products through one association—led to an almost equally conspicuous failure.

Governing Principles.—In its subsequent development, there have by degrees become recognised certain governing principles which may briefly be summarised as follows:—

1. The organisation of sale must be on a "commodity" basis and not by locality, that is to say, whilst there must be local organisation for receiving, packing and grading, the organisation as a whole must cover a wide producing area, and the local units must be federated in one central body in order to secure adequate control of the market.

2. The supply of produce must be regulated by binding contracts under which the growers pledge their produce to the association for a term of years.

3. The products must be pooled according to size, grade or other characteristic, so that whilst individual growers obtain returns in proportion to the amount and quality of their produce, the organisation of sale passes from these thousands of individual growers into the hands of one organised unit.

How these principles came to be evolved may be illustrated by examples from what actually occurred.

1.—Growers of citrus fruit (mainly oranges) were among the pioneers of the American co-operative marketing movement. The first attempt at co-operation in this trade dates back to the early days of commercial orange production on the Pacific Coast. Between 1877 and 1890 there was a very rapid development in the orange trade in California which soon resulted in "over-production"—there was a "boom" which was speedily followed by a general fall in prices. After an abortive attempt at self-protection through the agency of the Orange Growers' Protective Union, the growers turned to co-operation. The actual beginning was marked by the organisation of the Pachaffa Orange Growers' Association in 1888. Other local associations quickly sprang up, and succeeded in securing fairly good prices in the years immediately following, and during the early 'nineties. They were, however, hardly more than local marketing agencies disposing of their members' fruit in each district independently.

The next step was the establishment of district exchanges in each of the chief producing areas operating in conjunction with the local growers' associations. The organisation of local associations and district exchanges, however, was not enough. It gave the growers no real control over the marketing of the fruit, the associations competed against one another, and the market still tended to be flooded at the time of harvest, and prices to be depressed. Growers therefore sought to federate the local associations into one central body, and ultimately, in 1905, the Californian Fruit Growers' Exchange, the central marketing authority for the united organisation, was established. Thus the last link in the chain came to be formed; federation proved to be the way to success, and with the advent of the California Fruit Growers' Exchange the co-operative organisation for the first time obtained a commanding position in the market. This exchange has dominated the market practically since its inception, and with its formation the general structure of the marketing organisation, viz., local associations—district exchanges—central exchange, was complete. Upon this pattern the whole organisation as it exists to-day has been built up. At present there are 10,700 growers each contracting to deliver the whole of his fruit to the local association. There are 206 local associations concerned primarily with grading and packing, 19 district exchanges whose chief function is directing the fruit received from the local association to the markets, and finally the central co-ordinating body, the California Fruit Growers' Exchange. Upon the latter by reason of its commanding position falls the task of controlling distribution, of preventing congestion, and thus of securing to the grower what is the real achievement of co-operative organisation—a stabilised market.

2.—The second of the principles referred to above, viz., long-term producers' contracts, was evolved largely as a measure of self-protection. Many co-operative enterprises had in the earlier stages of their existence to withstand attacks from private dealers who endeavoured to tempt producers out of the co-operative organisation by offering high prices for their produce. It was precisely this difficulty which confronted the Danish co-operative movement in its earlier years, in fact, the long-period producers' contract applied to co-operative marketing, is a Danish invention, from which country it was adopted by the United States. Producers' contracts were first used in America by a Farmers' Elevator Co. in Iowa in 1889: they were adopted by the California orange trade in the early 'nineties, and at the present time have become almost the only practice of co-operative undertakings in that country.

The advantage of the contract system, however, is not confined to eliminating the disruptive attacks of outside dealers. It also adds greatly to the power of the co-operative organisation to control the markets, since the volume of produce to be handled is fixed within comparatively narrow limits, thus enabling the marketing policy to be developed with a fairly definite knowledge not only of the present but of the future supplies of fruit to be handled.

3.—The principle of "pooling" has, with a few exceptions, also become the recognised practice of American co-operative marketing associations. Here again its adoption has been the outcome of practical experience. It has been found that it both cheapens the operations of grading and packing, and enables an association to establish a reputation for its products in the market, to reduce wastage to a minimum, and to handle the various grades more easily. Pooling usually consists not merely in the physical mixing together of the growers' produce according to grades, but in the transfer of the control of sale combined with a proper distribution of the profits realised amongst the members of the association. It greatly facilitates, indeed it is essential to, the exercise of the association's full powers of control over the movement of produce to the market, and it has consequently come to be recognised as one of the primary instruments of market stabilisation. Pooling in this sense is not, however, invariable.

Economic Difficulties.—With co-operation established on these guiding principles, American agriculturists have sought to apply it on a wider scale, in remedying the specific economic difficulties which beset the marketing of agricultural produce. These are principally three in number: (1) Seasonal fluctuations in prices; (2) Fluctuations in prices due to temporary excess of supply over demand, *i.e.*, in consequence of exceptionally heavy crops; and (3) Wastage due to deterioration.

In order to overcome these difficulties, the recent development of the co-operative marketing movement has aimed not merely at eliminating the middleman and replacing him by a co-operative society—the advantage of which to the farmer is at best small, and often negligible—but rather at putting into the farmer's hands an effective instrument by which he can prevent or at least minimise violent fluctuations in prices.

That the seasonal drop in prices at harvest time is largely due to financial causes (*i.e.*, to the farmers' need for ready cash) is well recognised. In the United States it has been estimated that only 12 per cent. of the farmers are able to finance their own crop raising. Consequently the practice of unloading their produce on to the market at the earliest opportunity, both in order to raise money to meet their current obligations and to provide for subsequent operations, has been widespread amongst growers in every branch of agriculture. Of the cotton crop 70 per cent. is said to be dumped on the market by farmers during the period, September-December, and 65 per cent. of the wheat is marketed between the beginning of August and the end of November.

The farmer's need to raise cash on his produce lies at the root of the whole question; it is from one point of view the crux of the marketing problem, and it is because in the past—in a system of unorganised competitive marketing—he had no course open to him but to sell his produce outright for what it would fetch, that he remained a helpless victim of the seasonal slump in prices which not infrequently fell below the cost of production.

Control of Produce, and Bank Credits.—To meet these difficulties American co-operators have primarily endeavoured to secure two things: (1) the physical control of the movement of produce to market on the lines which have been described above, to an extent which gave the co-operative organisation a predominant position in the market; and (2) power to obtain bank advances by using the commodities themselves as collateral security. In practice this has involved an intermediate stage between the producer and the consumer in which the product is put into store—in the case of certain perishables into cold storage, and in the case of non-perishables into warehouses or other stores. Upon warehouse receipts the banks have been ready to make advances to co-operative marketing associations, on the same lines as has for many years been their practice in the case of wheat stored in elevators and cotton in warehouses. The association is thereby enabled to make an immediate advance to the growers—up to 50 or 60 per cent. of the market price—and still to retain control of the rate at which the produce is moved to the market. The development of this side of marketing operations has led to a considerable extension of the use of credit as a means of securing stabilisation of prices, and in the crisis which followed the general slump in prices in 1920 this machinery proved to be of the highest importance.

In 1922, the War Finance Corporation, a State credit institution with a capital of $500,000,000 created and guaranteed by the United States Government, was resuscitated, largely for the purpose of assisting agriculture over the crisis. During the season 1921-22 the Corporation authorised loans amounting to $64,000,000 to co-operative marketing associations, and in the following season similar loans were approved to the extent of $114,000,000 " to assist in the orderly marketing of the 1922 crops."

One quotation may be given from the annual report of the War Finance Corporation for the year ending 30th November, 1922, to illustrate the effect of these operations.

" In the midst of the worst depression that the cotton industry has suffered in many years it was through the co-operative marketing associations that the War Finance Corporation developed plans for extending assistance to the industry on a comprehensive scale. In the summer of 1921 when . . . . business throughout the Cotton Belt was in a demoralised condition, the corporation made its first loan to an association in Mississippi on 100,000 bales of cotton. The cotton was classified by the association according to grade and staple, and placed in bonded warehouses. . . . The loan enabled the association not only to make advances to its members for their urgent financial needs, but also to market the crop through a greater portion of the consuming year, instead of forcing it on a demoralised market."

Co-operative marketing plus State credit, proved in the period of crisis to be a means of stabilising the market, of preventing panic, and of restoring confidence, which was of almost incalculable benefit to farmers, and as a direct consequence of its success, a new impetus was given to the co-operative movement itself under which many new marketing associations were organised for handling cotton, wheat, tobacco, rice and other staple products.

Turning to the other aspect of the question—the control of the physical movement of produce to the market, the most significant development in this direction has occurred in the case of perishables. In those organisations where the development towards federation has reached the point of giving them a dominating position in the market, control of the movement of produce has become a systematised practice. Although production necessarily varies with seasonal conditions, it has become possible, through co-operative enterprise, to secure that the rate of delivery to market is determined by the demand of the market and no longer by the rate of production. Thus, in the case of butter and cheese the rate of production rises during the first half of the year to a maximum in June and thereafter declines to a low point in December, whilst the rate of consumption is relatively steadier throughout. From about the middle of April to the end of August there is consequently a definite "into storage" period during which the association receives from producers more than it sells, and from the beginning of September till the middle of April an "out of storage" period during which these conditions are reversed. Thus the market is supplied according to its needs and fluctuation in prices is reduced to a minimum.

Marketing of Wheat.—In recent months much attention has been directed by American agriculturists to what is perhaps the greatest marketing problem in the world—that of wheat. Both on account of the widespread depression of wheat prices and of the predominant importance of wheat amongst the agricultural products of the United States the present position in regard to the problem of orderly marketing of the wheat crop of America is one of exceptional significance. The marketing of wheat in the United States is a highly organised business. The system of bulk handling, storage in elevators, and bank credits, combined with highly skilled technical management, has led to an organisation in some respects without parallel in the world. It is, however, not an organisation built up on the principles which American agriculturists have now come to know as "orderly marketing"; it does not embody those elements by which alone stability of prices can be secured. Fundamentally the wheat organisation has been developed round the "speculator"—the person who buys from the farmer at harvest time when the grain comes into the market in a greater volume than the current consumptive needs, and sells it again after the flood is over. To the speculator fluctuations in price are not necessarily an evil and may be a source of considerable profit.

The movement for the co-operative ownership by farmers of grain elevators has in the past years undergone considerable development, but its success has necessarily been only a partial one. It has enabled farmer members to obtain credit on their produce, and to this extent has rendered an important service, but it has not achieved its ultimate object. The flow of grain to market still continues in a disorderly fashion and prices tend to fluctuate as widely as ever. The bulk of the crop is still sold by farmers soon after harvest, and the farmer has to be content with what he can get.

The continued depression in wheat-growing districts and the increasing political pressure which was being brought to bear on the United States Administration recently led the President to appoint a Commission consisting of Mr. Eugene Meyer, Jnr., and Mr. Frank Mondell, of the War Finance Corporation, to investigate the wheat situation. The Commissioners examined various proposals, and their conclusion is significant: "Co-operative marketing associations organised along sound lines and with competent management and business guidance, offer, at the present time, in our opinion, more promise of helpful results than any other plan or programme that has been suggested. They can do what the speculator cannot with safety be relied upon to do. They can by orderly marketing regulate the flow of wheat so that supply is adjusted from time to time to the consumptive demand."*

Co-operation is daily becoming more widely recognised in America as the cure for fluctuations in wheat prices. What has been wrong is partly that the principles of co-operative marketing have not been strictly applied in the case of grain, and partly that the practical difficulties are greater than in other branches of agriculture. With greater knowledge of the economic conditions of grain marketing, however, there would seem every reason to believe that these difficulties will eventually be overcome. The progress of organisation of wheat marketing in the United States during the next few years cannot but form one of the most interesting, possibly one of the most far-reaching experiments in co-operation in any country in the world.

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* Report to the President on the wheat situation, by Eugene Meyer, Jnr., and Frank W. Mondell.

Co-operative Marketing of other Produce.—It would be beyond the scope of this article to describe how these principles have been applied in other branches of agriculture, but there is no doubt that the success of the co-operative marketing movement* during the critical period of 1920-1922 has been the reason of its subsequent very rapid growth. In 1922 the turnover of American co-operative marketing enterprises exceeded one thousand million dollars—a five-fold increase within a decade. Most of the principal farm products are now successfully marketed through co-operative organisations, ranging from a small proportion of poultry and vegetables up to 75 per cent. of American-grown citrus fruits, 90 per cent. of dried fruits, 70 per cent. of tobacco, while they also deal with 25 per cent. of milk and milk products, and 20 per cent. of cotton. In all about 1,200,000 farmers belong to these commodity organisations, the cotton associations of the Southern States—to take an example—having a membership of more than 200,000. In regard to the latter it has been stated that every member who marketed his crop last year through a cotton association received at least $20 per bale more than the non-members received for the same grade and quality of cotton.

In conclusion, two quotations may be given from a book† on which much of the information in this article is based:—

"Intelligent merchandising of farm commodities through co-operative associations leads finally to a stabilised agriculture, in which fluctuations in prices are minimised, risks of operations greatly reduced, and a premium placed upon the farmer's ability as a producer."

"The farmer retains his individualism as a producer, but he puts group selling to work as his sales manager. Neighbour joins with neighbour, they pool their product, each man has one vote in the control, and they share and share alike in a new system of economic justice for agriculture."

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* See the *Statist* article on "The Growth of American Co-operative Marketing," 24th November, 1923, p. 710.

† "Co-operative Marketing: The Golden Rule in Agriculture," by Herman Steen, American Farm Bureau Federation Library; Doubleday, Page & Co.

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PIG-KEEPING.

V.

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General Principles in the Construction of Pig Sties—Shelters for Open Air Pig-keeping—Fencing—Appliances for weighing Pigs.

Permanent Pig Sties.—It has been pointed out by Mr. Sanders Spencer that pig sties may be described as of three kinds—those which are ornamental, those which are useful, and those which are neither one nor the other. It has been our experience that the conventional type of sty usually belongs to the third class. Pigs, however, do not require elaborate or expensive housing. It is not within the scope of this article to deal in detail with the planning of modern piggeries, but certain broad principles which should be observed in their construction would appear to bear repetition, as they are by no means uncommonly neglected.

The main points of importance in a pig sty are that it should protect the pig from excessive cold and heat, from rain and draughts, and more particularly from cold winds from the north and east. It should be well ventilated and airy. Sun is one of the best germicides and it will help to maintain healthy conditions if the sun's rays can penetrate to all parts of the sty in the course of the day. On the other hand, it will be found a great advantage in hot weather if some simple means of excluding the sun's rays is also provided. Wooden shutters on hinges might serve the purpose in certain circumstances. Many sties which are built facing south without some provision of this sort become unbearably hot during the heat of summer.

The floor should be made of material which will enable the sty to be thoroughly cleansed and disinfected from time to time. Concrete forms a sanitary and inexpensive floor, but it is cold, and if it is not possible to give a liberal supply of bedding it is a good practice to provide a movable wooden platform for the pigs to lie on. It is essential that this platform should not be a fixture but such that it can be taken out of the sty to be cleansed and exposed to the sun, when it has become wet and dirty through absorbing moisture. It is decidedly prejudicial to the health of the pigs to have them lying on an evil-smelling and urine-soaked platform.

Bricks laid in concrete or in sand are usually regarded as forming a satisfactory floor. In comparison with concrete, bricks are rather warmer but less sanitary. Floors are fairly commonly made of rammed clay or chalk. These are fairly satisfactory but pigs are inclined to root them up, and they are not impervious to moisture. With regard to drainage, surface drainage is the more sanitary; and it is important to see that sufficient fall is provided.

Sties are often built with low walls, and with one small permanent opening leading into a little yard. These low walls are possibly favoured for economy in building, but low-walled sties are rarely really healthy. The atmosphere is usually close and stuffy, and they are uncomfortable both for the pig and for the man who has to clean them out, as he has to work in a crouching and unnatural position. Walls should be at least 6 ft. 6 in. high Corrugated iron is fairly commonly used for roofing, but when used alone it is not satisfactory as it is readily affected by heat and cold, with the result that a sty with this type of roof is too hot in summer and too cold in winter. Corrugated iron along with straw thatch makes quite a good roof. Generally speaking, well constructed cattle boxes, especially those with exercise yards, ordinary covered yards, or partly covered yards such as are common in the north-east of Scotland, can be utilised to form suitable accommodation for pigs.

Fresh air, sunshine, and protection from extremes of heat and cold, together with sanitary floor conditions and facilities for exercise in the open air go far to secure keen appetites, good digestion, the maintenance of sound health, and freedom from tuberculosis and other diseases.

Shelters for Open Air Pig-Keeping.—Since open air pig-keeping became widely practised, many different types of shelters have been devised. Where the system involves permanent enclosures, the shelters usually take the form of stoutly made wooden huts, of a more or less permanent character. In constructing these wooden huts, the general principles already outlined should be applied. When wood can be obtained cheaply, an economical and satisfactory roof can be made with wood and felt.

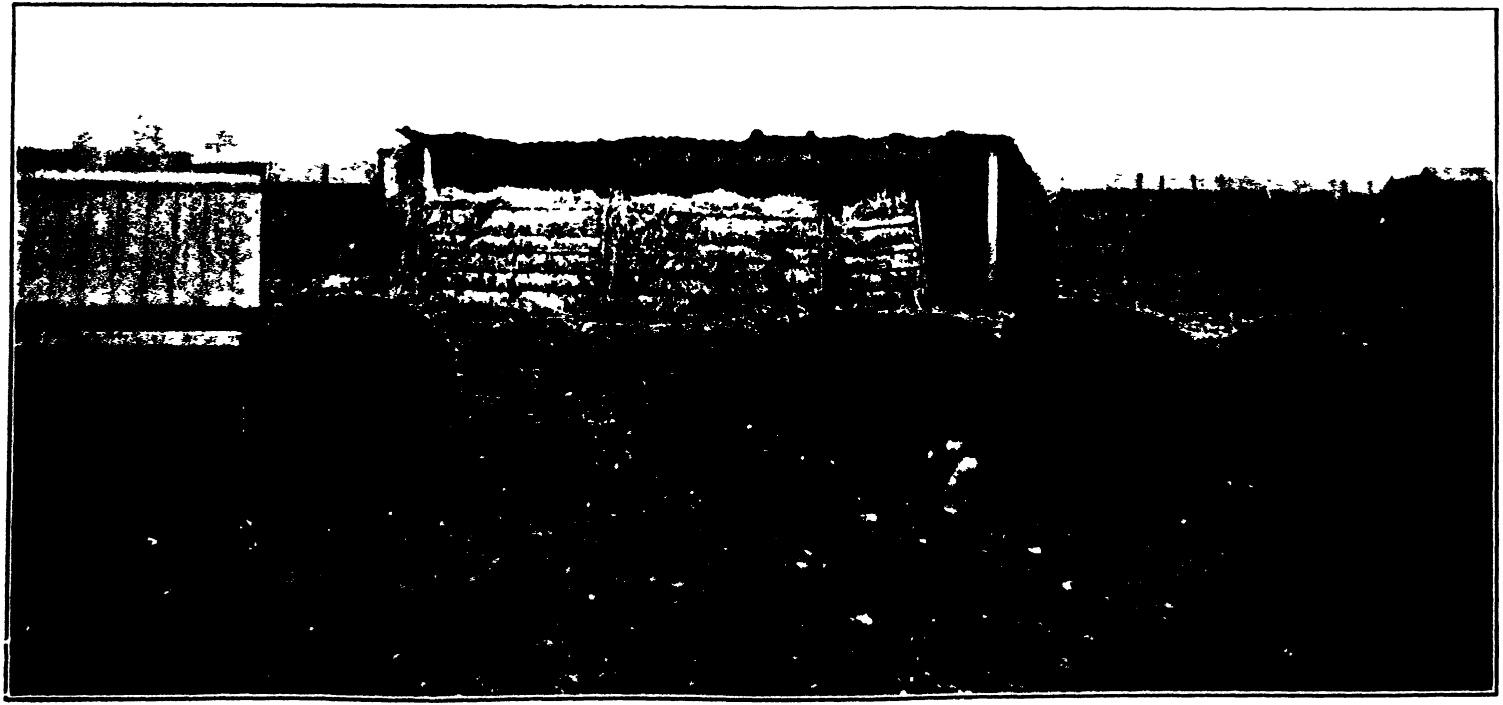

FIG. 1.--The first type of Pig Shelter used on the Northamptonshire Experimental Farm, Moulton.

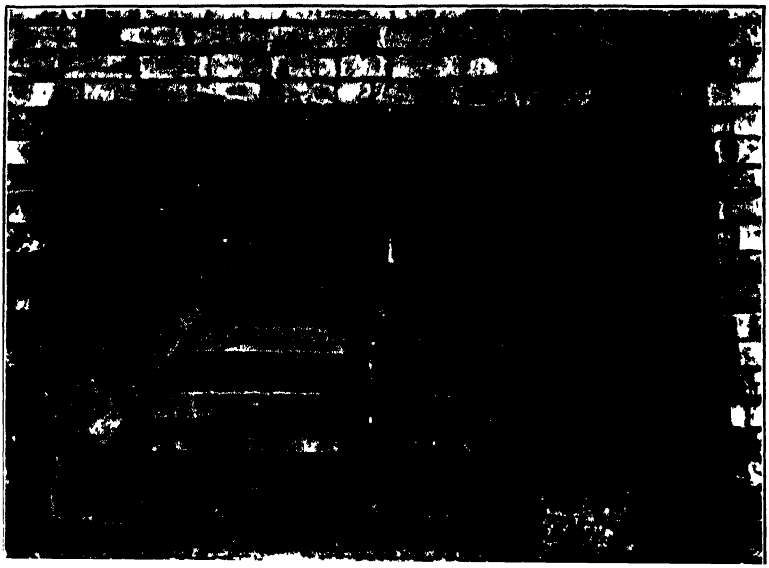

FIG. 2.—Boarded Hurdle used for making Shelters

FIG. 3.—A Shelter Roof made of corrugated iron sheets thatched with straw on the under side.

For a system of management such as that practised on the Moulton Experimental Farm, movable shelters are much more useful than permanent and stationary huts. These movable shelters permit the practice of an elastic policy, whereby it is possible to run the pigs where they can be most profitably employed at any particular time. It may be to utilise arable land crops, to glean and clean the stubbles, or, if at any time arable land crops are not available, the shelters and the pigs can, with little expenditure of time and labour, be moved on to grass land. Our first type of shelter was made with thatched hurdles for the sides, back and front; and a roof consisting of corrugated iron thatched with straw underneath and fixed to two cross beams by means of bolts and nuts. Posts were used to support the roof in front, and at the back it was fixed to the tops of the hurdles.

Fig. 1 illustrates a rather roughly made shelter of this type. The gilts shown in the photograph lived in this shelter during the whole of the winter of 1922-23, on land where a crop of potatoes had been grown in the 1922 season. The potatoes had not been gleaned by hand and the gilts, fourteen in number, were penned on areas of about an acre at a time. They cleaned up the potatoes very effectively; practically none could be seen growing in the subsequent barley crop. On a ration of 4 lb. of dry meal per head per day together with the potatoes, they developed nice condition This type of shelter, however, is not altogether satisfactory. The straw gets pulled out by the pigs and the hurdles require to be re-stuffed from time to time. Stuffed hurdles are not handy to move and they have now been abandoned in favour of wooden boarded hurdles of the kind shown in Fig. 2. The smaller size is used for the sides and back of the shelter and the higher size for the front. The smaller size is 6 ft. long, 3 ft. deep and the heads are 4 ft. high. The bigger size is 7 ft. long, 3 ft. 3 in. deep and the heads 4 ft. 6 in. high. Three-quarter-inch tongued boarding, 4½ in. wide, is used.

A thatched roof is shown separately in Fig. 3, to illustrate the method of thatching on the underside. The sheets of corrugated iron employed to make the roof are 2 ft. wide, by 7 ft. long. Bolts of various lengths are used to fasten the iron sheets to the two cross beams The thatch is supported by narrow wooden bars which are usually obtained from old or broken hurdles.

For heavy land conditions, a shelter like that shown in Fig. 4, made with wooden hurdles and a one-piece roof, can be recommended; but for moderately dry and light land, a shelter on wheels or runners is a great convenience on account of the ease with which it can be moved. Wheels add considerably to the cost and it is doubtful whether they are necessary. Wooden runners or skids, preferably shod with iron, have been found satisfactory. A shelter of this type can be moved by yoking one horse to it. It provides a simple solution of the labour difficulty involved when frequent changes of position are required. In securing uniform grazing and uniform distribution of manure, particularly when pigs are folded on arable land, it is essential that the shelter should be moved frequently. A further advantage in its favour is that its position can be altered without difficulty whenever necessary in order to secure the most favourable exposure to afford protection from wind or rain, or in very hot weather to obtain the maximum shade from the sun.

The shelter shown in Fig. 5 has the following dimensions:—Length 8 ft., width 6 ft. 6 in., height 4 ft. at the front and 2 ft. 9 in. at the back. The floor is of 1-in. elm boards on two 6-in. by 2 in. oak skids. Sides, front and back are of ¾-in. tongued boarding; roof of ¾-in. square edge boarding covered with sanded felt: upright posts 3 in. by 3 in.; doorway 2 ft. wide. A hinged door which opens outwards and downwards forms a platform for the pigs to walk on when going out and in. A farrowing rail is provided when required.

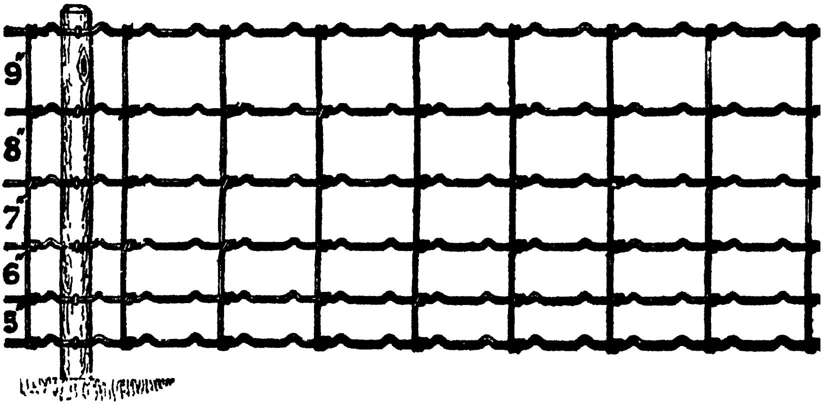

FIG. 6.—Light type of Fencing.

Fencing.—Several inquiries have been received recently as to the most economical form of fencing. At current prices we favour a make of wire which is offered at 5½d. per yard in 55-yard rolls. This fencing (*see* Fig. 6) is 35 in. high with verticals 12 in. apart. There are six horizontals, which are

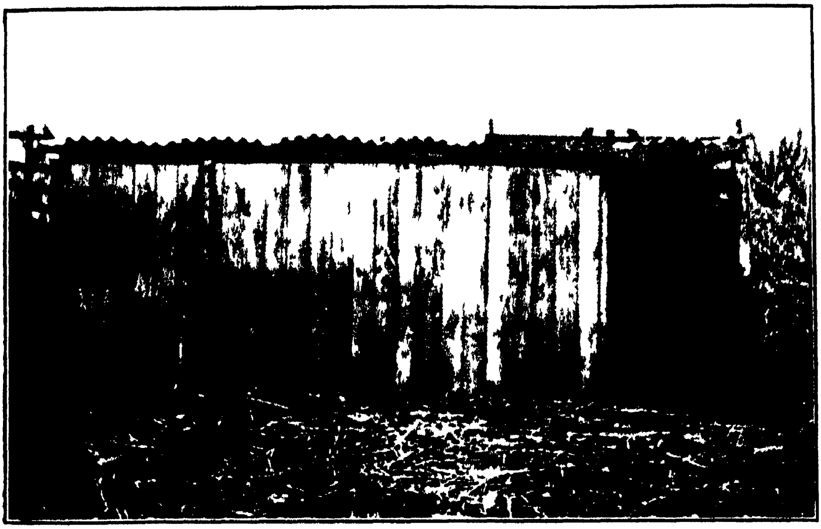

FIG. 4.—Second type of Shelter used on the Northamptonshire Experimental Farm. Boarded Hurdles replace Thatched Hurdles.

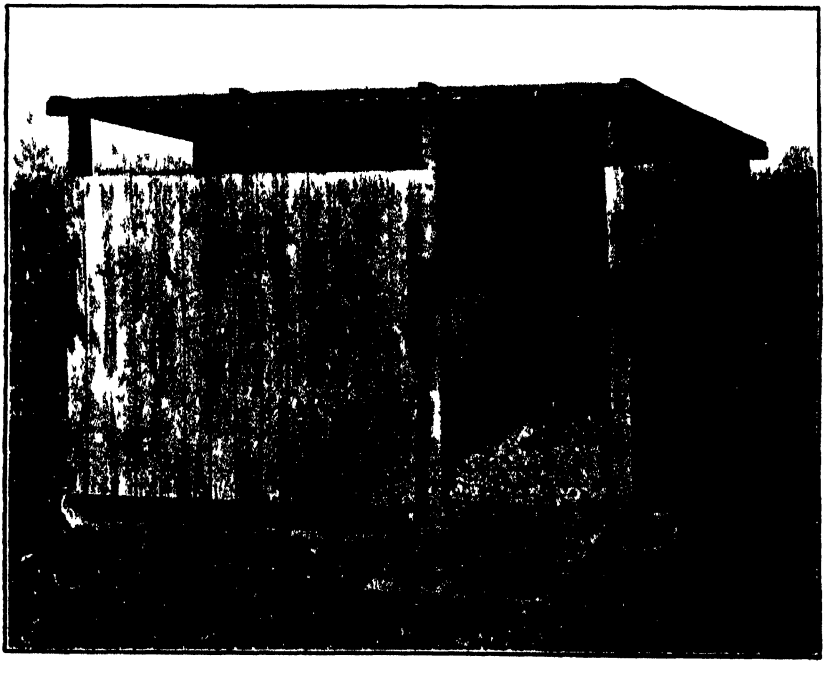

FIG. 5.—A Moveable Shelter on Runners in use on the Northamptonshire Experimental Farm.

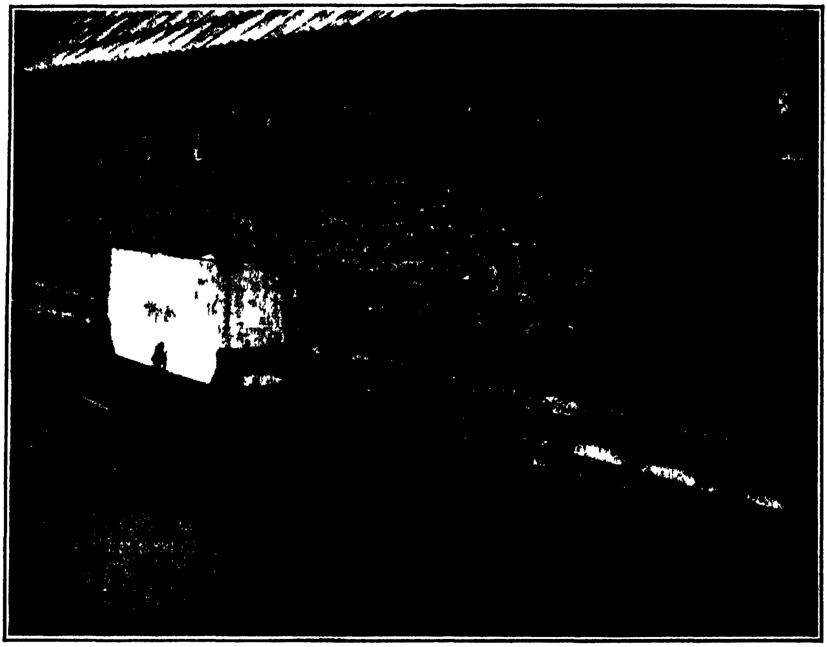

FIG. 8.—Feeding Trough and Trolley on rails for conveying the food

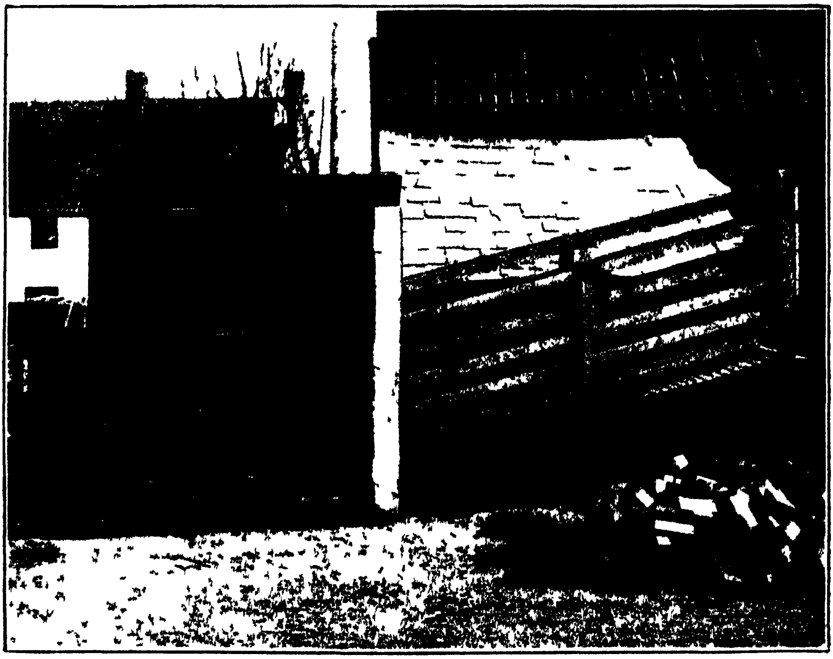

FIG. 9.—Weighing House and Loading Dock

5 in apart at the bottom and 9 in. apart at the top; the intermediate horizontals being 6 in., 7 in., and 8 in. apart, widening from the bottom upwards.

A heavier type of wire with verticals 6 in. apart, and 8 horizontals 3 in. apart at the bottom widening to 6 in. apart at the top, is being offered at 8½d. per yard. This class of wire (Fig. 7) is considerably stronger, and the smaller mesh is an advantage for fencing in small pigs, but for most classes of pigs used to outdoor conditions, the cheaper type of wire is satisfactory, particularly for arable land fencing. A strand of barbed wire along the ground is sometimes recommended, but this should not be necessary except for very troublesome pigs. Both types of wire are sold in two weights; the lighter weight is found sufficiently strong.

Stakes are required at intervals of four yards. Home-made stakes 3 in. by 3 in. and 4 ft. 6 in. long, obtained from wood felled on the farm, are used on the Experimental Farm. The stakes are cut out with a small power-driven circular saw 24 in. in diameter, which was installed in 1922 at a cost of £15 and which has proved a very economical purchase. The power for driving the saw is provided by the engine which is also used to drive the grinding mill and root pulper. It is very important to get the wire stretched tight before fixing it to the stakes. A useful wire strainer for this purpose is sold by most agricultural implement dealers at a reasonable cost.

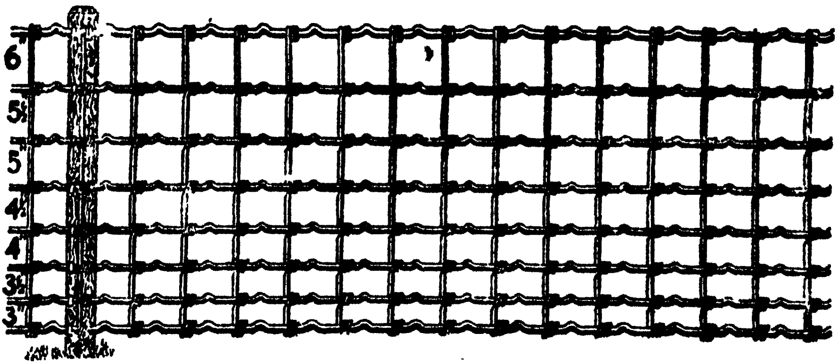

FIG. 7.—Heavier type of Fencing.

General.—In the general laying out of pig pens, the importance of making use of existing hard roads for carting feeding stuffs or water should be kept in view. The more convenient the pens are to the central feeding house, the less labour will be required in feeding. If pens can be so arranged that a stream or other water supply is utilised so that pigs find their own drinking water, it will still further economise labour, especially where dry feeding is practised. Fig. 8 shows a feeding trough in a yard on Lord Bledisloe's Cross Farm, Lydney. The trolley on rails is used to convey the food from the feeding house to the troughs. The importance of having a weighbridge on the farm cannot be overestimated. An ordinary spring balance weighing up to 550 lb. and crate will be found very useful. Fig. 9 shows a combined loading dock and weighing house on Lord Bledisloe's farm.

In concluding this series of articles written at the request of the Ministry, I wish to express my grateful thanks to my colleagues, Mr. W. R. Seward and Miss J. W. Strang, for the assistance which they have given to me.

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DAIRY FARMING IN HOLLAND.

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THE greater portion of Holland's milk is produced on small farms, *i.e.*, farms of from 5 to 30 acres. Farms of 60 acres are considered large, and are by no means common. Rents vary from about £3 10s. to £6 per acre, including tax. The breed of cattle kept is the Friesian, either black-and-white or red-and-white, the former predominating. The cost of dairy cows 2½ years old ranges from £28 to £33, and the average annual yield of a cow in full milk is about 1,000 gallons. Young cows with first calf give less than this quantity, but taking the figures given at one of the factories—which must be accepted as being approximate, at any rate as to the number of cows—the yearly average yield from the 3,000 cows producing milk for this factory is 800 gallons per cow.

The average fat content of the milk supplied to the factories is around 3·3 per cent., although in Friesland it is reported that many herds produce milk with a fat percentage of 3·75 per cent. or higher.

Some of the factories render good service to their members by taking frequent samples of the milk from each cow from which milk is supplied, and the information thus obtained, in conjunction with the records kept of the quantity of milk given, forms a very useful guide to the farmer in weeding out unprofitable cows. The various Cattle-Herdbook Associations are responsible for carrying on propaganda work, as well as the supervision of milk recording, and for ensuring that animals entered in the herdbooks are not only bred for producing a high quantity and quality of milk, but are also symmetrical in form and fully developed in body. One very interesting activity of the Herdbook Associations, and the Association of Co-operative Dairy Factories in Friesland, is what is known as a " Sanitary Service " for cattle in Friesland. This Sanitary Service is always on the look out for sick animals, in order to remove them from the herd, and also endeavours to secure a healthy system of rearing young cattle. It pays special attention to tuberculosis and abortion, and regularly examines the herds of the members for the detection of these diseases. All animals causing danger to the herd are removed and killed.

A special pamphlet has been written in English on " The Original Breed of Friesian Cattle " and can be obtained from The Friesian Society of Agriculture, Landbouwhuis, 11, Willenaskade, Leeuwarden, Holland.

Dairy Factories.—The factory system is fast replacing the manufacture of dairy products in the farmhouse, and at present there are no fewer than 960 dairies in Holland, 686 of them being co-operative, and the remainder proprietary. The growth of the factory system has been encouraged (1) by the law that all milk shall be pasteurised before being sold for consumption, (2) owing to the large number of very small holders that exist, and (3) by the fact that a large proportion of produce is exported.

The co-operative factories seen by the writer were well designed and well equipped, particularly those of more recent construction.

When an association of farmers desires to establish a co-operative factory, the Land Bank is approached for a loan to cover the cost of construction and equipment, this amount being guaranteed by each and every member of the proposed factory. In this way membership does not involve direct capital outlay, but each member must guarantee to pay his share of liabilities, up to any amount, if that is necessary. He must also bind himself to deliver all the milk of his cows for handling at the factory, and in some cases he is liable to a fine of five guilders per 1,000 litres (8s. 4d. per 222 gallons) in respect of the quantity of milk he has supplied to the factory during the 4 years immediately preceding, if his supply is withdrawn without the consent of the Directors.

The milk is usually bought and paid for on the butterfat basis. In a purely butter-making factory the price paid is 7½ to 8 cents per litre (6·75d. to 7·2d. per gallon) in winter, and 4½ cents per litre (4·05d. per gallon) in summer, and in addition the farmers receive their quota of separated milk and buttermilk free. In cases where milk is purchased by factories for disposal as liquid milk, the price paid is 11 cents per litre (9·9d. per gallon) in winter, and 7 cents per litre (6·3d. per gallon) in summer.

For separating, the milk is heated to a temperature of 30° C. (86° F.), the cream being further pasteurised to a temperature of 83° C. (181° F.), and then cooled to 13° C. (55° F.), before starter is added

Many of the factories make cheese, as well as butter.

At one of the most up-to-date factories, where this system is in vogue, the milk is received twice daily. The receiving platform is open, and equipped with a weighing machine on each of three sides. From the weighing machines -which are of the dial type and Danish manufacture—the milk is run into a receiving tank, from which it is pumped over a water cooler, and afterwards run by gravitation into jacketted vats, where it is left for a given period—usually about 12 hours— in order to allow the cream to rise. The lower layer, of partially skimmed milk is run off and made into cheese, whilst the cream, or upper portion, is pasteurised, ripened, and made into butter.

The skim milk is made into Edam and Gouda cheeses, which are quickly made, the time taken between renneting the milk and putting the curd into moulds being from 2 to 2½ hours. When the curd has been in the moulds for from ¼ to ½ an hour, it is turned, then left for 2 hours more, and afterwards put under pressure for 3 hours. When taken from the press the cheeses are trimmed, and placed in brine for 3 or 4 days. The brine, which is contained in large cement brining tanks, is kept circulating and cool by being pumped over a water cooler. In some cases the cheeses are coloured and waxed at the factory, but usually this is done by the Marketing Association. At this factory the whey is pumped into large tanks at the top of the building from which it is run through a separator to abstract the butterfat. The whey cream thus obtained is pasteurised and made into butter. Whey separation does not appear to be the general practice in Holland.

There does not appear to be provision at the factories for sterilising the milk churns, probably because the whey and separated milk are usually returned in the cans used for bringing new milk to the factory.

The farmers utilise the separated milk and whey for calf rearing and pig feeding. The German type of pig is usually kept, although it was stated that it is not very popular with the slaughterers.

Combination of Co-operative Dairies.—The next step in the co-operative structure is the combination of a number of co-operative factories, either for the purchase of their requirements, or the disposal of their produce. At Leeuwarden were seen four distinct examples of the way in which various co-operative dairies in Friesland amalgamate for (1) retailing milk, (2) dealing with surplus milk, (3) manufacturing dairy requirements, and (4) marketing cheese, butter and cream.

(1) *The Co-operative Steam Dairy* at Leeuwarden deals with 3,000 gallons of milk per day, some of which is pasteurised and sold as liquid milk. The remainder is separated, a portion of the cream being sold and the rest made into butter. The separated milk has such a proportion of cream added to it as will make a 20 per cent. or 10 per cent. Edam cheese, in accordance with the market demands. Another product at this factory is buttermilk soup, made by boiling pearl barley in the buttermilk. This is put up for sale in sterilized, stoppered, glass bottles.

This dairy sells the bulk of its products retail in the town of Leeuwarden. The whey, and as much of the buttermilk as is not made into soup, are returned to the affiliated factories or sold to local pigfeeders.

It is interesting to note that at this factory all the cheese moulds are periodically sterilized with live steam in a special chamber.

The price paid to the affiliated farmers' factories for milk is 11 cents per litre (9·9d. per gallon), and the retail price is 15 cents per litre (13·5d. per gallon).

(2) *The Co-operative Milk Products Factory* at Leeuwarden is owned by 45 farmers' co-operative factories for the purpose of dealing with the surplus milk of these factories. The amount of milk dealt with is about 22,000,000 litres (nearly 5,000,000 gallons) per annum. The price paid for the milk varies with the current price of cheese, and any profits available at the end of

the year are distributed among the affiliated factories in proportion to the amount of milk supplied by them.

The milk is made into sweetened and unsweetened condensed and evaporated milks for sale in Holland, as well as for export. The evaporated milk is condensed to half bulk, and then homogenised before being put into hermetically sealed tins. All tin containers are made on the premises, the maximum output being 70,000 tins per day. All the boxes required for packages are also made up on the premises.

Each affiliated factory agrees to send at least one-tenth of its total supply to the condensery for a certain portion of the year.

(3) *The Co-operative Rennet and Dairy Requirements Factory* at Leeuwarden is owned by 70 farmers' co-operative factories. It manufactures rennet, paraffin wax, colouring, lime soap, and other dairy requisites for sale to the affiliated factories and others.

(4) *The Friesche Co-operative Zuivel-Export Vereeniging Leeuwarden—Nederland*, was established in 1898 for the purpose of selling the milk products of the farmers' co-operative creameries, which are members of the Export Association.

At its large warehouses in Leeuwarden, the Association provides storage accommodation for 1,500 tons of cheese and 40,000 casks of butter All cheese and butter is sold subject to inspection by the. Government and the Friesian Co-operative Creameries' Control Institutes. The cheese may be made from full milk and contain not less than 48 per cent. of butterfat. or halfmilk containing not less than 30 per cent. of butterfat.

The store rooms for cheese are all served by a cold air duct, so that the temperature can be regulated even in the hottest weather. The butter store is kept at a temperature of 5° to 8° C.

When cheeses are required for export to the tropics, they are tested and tried out by being placed in a room kept at a high temperature, before being coloured and waxed ready for dispatch. Cheese and butter are also prepared for export by being put up in sterilized tins, which are hermetically sealed after filling

Cheshire and Edam cheeses are treated by being immersed in paraffin wax heated to a temperature of 120° C., to reduce the loss by evaporation.

Affiliated factories forward consignments of cheese or butter to the store each week, thus preventing congestion in their own stores. The Marketing and Exporting Society has the right to instruct the factories to manufacture any type of cheese that may be required to meet the market demands, for the time being.

The General Netherlands Dairy Association.—The majority of the co-operative dairies are members of this Association. Its objects are to improve the quality of the produce of the factories by means of weekly competitions, by holding courses for the dairy staffs, by yearly examinations to test the efficiency of aspirants for the positions of assistant manager, butter-maker, cheese-maker, engineer and milk inspector respectively, as well as by giving advice and assistance with the building and equipment of new factories. It also purchases such requirements as coal, oil, packing materials, milk testers, etc., for the joint account of the federated associations.

The association concerns itself with collecting detailed statistics of the administration and work of the associated factories, as well as with publishing a weekly paper for the general propaganda of co-operative dairy work.

Butter and Cheese Control Laboratories.—The various butter and cheese control stations do not receive any financial assistance from the Government, although their operations are always under the strict supervision of Government officials.

Butter control was established in 1901 and in order to guarantee the purity of Netherlands butter a Government mark has been introduced. This Government mark is only placed on the butter made in dairies which are under the strict supervision of one of the seven butter control stations. It not only guarantees purity but also that the butter does not contain more than 16 per cent. of moisture.

Cheese control was established in 1907, and, as with butter, a Government mark is issued for each of the 4 standards of quality of cheese produced, namely—

* Full-cream cheese containing not less than 45% butterfat.
Part " " " " " " 40% "
" " " " " " " 30% "
" " " " " " " 23% "

The control mark for full cream cheese consists of a red transparent piece of casein with the Dutch coat-of-arms, and an inscription at the back in blue.

The control mark for cheese other than full cream, consists of a round, uncoloured, transparent piece of casein with the figures 40+, 30+, or 20+, according to grade, in a black hexagon with inscription. These marks are pressed into the cheese whilst in the moulds, thus becoming a portion of the rind, so that they cannot be removed without being broken.

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* Full-cream cheese denotes cheese made from whole milk, and part-cream cheese that which is made from partially skimmed milk.

Even if the disc is taken off, the figures, which are printed on the under side, will remain on the cheese.

The marks for both butter and cheese have also a letter mark, and are numbered consecutively, by which means, with the help of control registers, it is always possible to trace the place and date of manufacture, in the event of a complaint being lodged.

For milk there is a definite fixed standard of 2·8 per cent. of butterfat, but no standard for solids other than fat.

The control stations are run by committees of management, the majority of the members of which must be non-producers. Members must also be of good reputation, not be concerned with the manufacture of margarine, nor be interested in the butter or cheese trade—presumably as traders or factors.

One of the outstanding features of this control system is the incentive it gives for the constant and careful steps taken to control the quality of the produce at each stage of its manufacture, and subsequent handling. The co-operative factories, the marketing associations, the dairy associations, and the control stations, all possess well equipped laboratories and qualified dairy chemists.

The co-operative system, as developed in Holland, tends towards specialization—the farmer in milk production, the factory in the production of the best quality of milk-products, and the marketing associations in finding the best markets, and providing the goods required by those markets.

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THE UTILISATION OF WASTE PRODUCTS IN AGRICULTURE.

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THE utilisation of industrial residues and waste products for agricultural purposes, as feeding stuffs or manures, and even for human food, was a subject that perforce attracted much attention during the late war both in allied countries and, especially, in Germany. Although many of the expedients adopted on both sides to eke out dwindling resources of feeding stuffs and manures were uneconomic, and therefore bound to disappear on the return of more normal conditions, some of the information gained was of permanent value even in time of peace. The whole subject has recently been exhaustively reviewed in a monograph by Prof. A.

Bruttini,* who has collected a large amount of valuable information, derived from allied and from German sources.

Waste products can in certain cases be utilised for manurial purposes, for cattle feeding, or finally for human food. From the agricultural point of view it is the first two of these methods which are of special interest.

Many more waste products can be used as manures than as foodstuffs, for, apart from products possessing no animal-feeding value, many which do possess such value also contain substances harmful to animals, rendering them unsuitable as feeding stuffs. On the other hand, there are few waste materials which do not contain plant food, available or potential, or constituents capable of exerting a beneficial effect on the physical properties of the soil, and even when they also contain bodies inimical to plant growth, such harmful bodies are often destroyed after incorporation with the soil.

The economic utilisation of waste products in agriculture is mainly determined by their bulkiness and water content in relation to the amount of nutrient elements and organic matter they contain. The cost of transport, or of drying down, may be so high as to render the product, as finally used, more expensive than any of the recognised artificial manures, when the comparison is made on the unit value of the fertilising elements. The utilisation of many waste products thus depends on whether they are produced in close proximity to agricultural land, so that freight charges can be eliminated or reduced to a minimum.

Sewage.—There can be no doubt that under the conditions of modern civilisation, by far the biggest source of waste, from the point of view of agriculture and food production, is that entailed in sewage.

In rural districts unprovided with main drainage, a large part of the excretory products of the population may find its way back, sooner or later, to the land, but in urban and industrial areas enormous amounts of most valuable fertilising material are lost well-nigh irretrievably in the sewage effluents which are discharged directly into, or find their way ultimately to the sea. Considering the question of nitrogen alone, an adult man excretes on the average 16 grammes of this element per day, the quantities for a woman and a child being respectively 13 and 8 grammes. In the British Isles, with a population of over 45 million, of which roughly half are on main drainage systems, there are nearly 120,000 metric tons of nitrogen lost into the sea every year, equivalent to the nitrogen of 600,000 metric tons of sulphate of ammonia. Unfortunately, a large part of this nitrogen exists in sewage effluent as soluble compounds in a state of very high dilution. A small part of this nitrogen may be utilised on special sewage farms, but the greater part is inevitably lost. The use of straw filters for the recovery of this soluble nitrogen, which is discussed later (p. 916), presents too many practical difficulties to offer much hope of a general solution of the problem, and short of the discovery of a cheap chemical capable of precipitating nitric and ammoniacal nitrogen from very dilute solutions in an insoluble form—a very remote possibility from the chemical point of view—it appears as if this enormous loss of nitrogen into the sea is unavoidable.

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* Ramassage et Utilisation des Déchets et Résidus, by Prof. Arturo Bruttini, published by the International Institute of Agriculture, Rome, 1922. To be obtained from the Ministry of Agriculture, 10, Whitehall Place, London, S.W. 1, price 20 Frs. An English Edition of this book under the title *Uses of Waste Materials*, has now been published by P. S. King & Son, price 12s. net.

A small, but in the aggregate, important proportion of the nitrogen in sewage is present in an insoluble form as sludge. The older processes of sewage purification give rise to a sludge, the solid matter of which contains only a very small percentage of nitrogen, so small as to render the sludge of little value as a manure. In recent years, however, a new method of purification has been developed, which results in a sludge known as "activated sewage sludge." This contains a much higher percentage of nitrogen and the other fertilising elements than the older sludges.

Trials have been carried out at Rothamsted* with activated sludge, made at the Harpenden sewage works, of the following composition:—

Composition of Dry Matter of Activated Sewage Sludge.

Type of Sludge		*Total Nitrogen %*	*Organic Matter*	*Phosphoric Acid (P_2O_5)*	*Potash (K_2O)*
Harpenden Activated 1.	...	4·93	62·05	2·86	0·28
" " 2.	...	5·94	73·30	3·00	0·43
" Slate bed †	...	2·63	46·80	0·34	0·08

It will be seen that the activated sludges are markedly richer than the old type of slate bed sludge in all three essential fertilising constituents. Manurial trials with the activated sludges were carried out on hay, potatoes and barley. Generally speaking, the activated sludge gave good yields in comparison with sulphate of ammonia or farmyard manure applied to give equal weights of nitrogen to the plots. Activated sludge thus possesses a high manurial value in marked contrast with the old type of sewage sludges tested on the Rothamsted farm in past years.

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* E. H. Richards and G. C. Sawyer, *Journ. Soc. Chem. Ind.*, 1922, 41, 62, T.

† For comparison.

It has been calculated that from the sewage of all the towns of the British Isles with a population of 100,000 or over, 1,800,000 tons of sludge are produced per annum, so that if this were all of the activated type, a by no means negligible amount of an apparently valuable organic manure would be made available for agriculture. The activation process of sewage purification is, however, only carried out in a few centres in this country, and even there on little more than an experimental scale. Until the process has been put on a sounder economic basis, both as regards the cost of activation and the drying of the sludge, it does not offer much immediate promise of becoming a source of benefit to the farmer.

It was mentioned above that roughly only half the population of this country is served by main drainage, and that the waste products of the other half may ultimately find their way back to the land. From the point of view of the agricultural utilisation of these waste products, however, there are great possibilities of improvement. Practically the whole of the agriculture of China is founded on the use of night soil as manure, and a very elaborate organisation has existed in that country from time immemorial for the collection and agricultural use of human waste products. It is estimated that in China nearly 180,000,000 tons of such products are used every year, representing over 800,000 tons of nitrogen, 250,000 tons of phosphoric acid and 300,000 tons of potash. The manurial utilisation of human waste products finds a more limited, but still extensive application in certain European countries, notably in Flanders—hence the name of "Flemish manure"—and in certain parts of France and Italy.

Although there is little possibility of such extensive development in this country, the subject merits careful consideration in view of the growing scarcity of animal manure. So far from being unhygienic, as it might at first sight appear, the manurial utilisation of human waste products, properly organised, would in many cases make for a distinct improvement in the sanitary conditions and general health of many of our villages, in which the frequent occurrence of epidemics is without doubt partly attributable to unhygienic methods of sewage disposal. It is difficult to devise methods of general applicability, but rural authorities and estate owners could render a great public service by devoting serious attention to the special condition of their own districts with a view to the introduction of methods of sewage disposal which would be hygienic and at the same time not agriculturally wasteful.

Town Refuse.—Another type of domestic residue of some agricultural value is that obtained in urban districts, consisting of the refuse collected by the municipal and urban authorities from road sweepings and house refuse. This material is of course of a very varied nature, and contains much of no manurial value, but many of the larger towns and cities now have installations for treating and sorting this refuse. The crushed and sifted material is of distinctly promising value as a manure. It is unnecessary to devote space to the subject in this article as it has recently been specially dealt with in this *Journal.** Manurial trials of refuse in comparison with town stable manure are being carried out at Rothamsted this year.

Sea Products.—Turning next to natural organic products not of domestic origin, it is convenient first to consider those derived from the sea. As already pointed out, modern systems of sewage disposal result in the loss by discharge into the sea of enormous amounts of nitrogen, phosphorus, and potash. In the distant future the time will arrive when the present-day resources of those fertilising materials will be approaching exhaustion, and it is probable that when this is the case, the resources of the sea will have to be utilised. As far as the supply of nitrogen is concerned, the atmosphere is available as an alternative source, and without doubt, by the time that our supplies of combined nitrogen are exhausted, industrial processes for the fixation of atmospheric nitrogen will have been so far developed that they will be able to supply our needs. For potash and phosphates, however, the sea will probably then be the only alternative source. The potash and phosphates which find their way into the sea ultimately serve for the growth of the higher marine organisms, animal and vegetable, of which the most important representatives are fishes and seaweeds respectively.

Seaweed.—In the wet state seaweed is not very different in composition from farmyard manure, though it is somewhat poorer in phosphoric acid; its average percentage composition is: water,

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* November, 1922, p. 685; December, 1922, p. 838; December, 1923, p. 870.

70.80; organic matter, 13.25; nitrogen, 0.3-0.5; potash (K_2O), 0.8-1.8; phosphoric acid (P_2O_5), 0.02-0.17. Manurial trials carried out in Scotland and Ireland show that wet seaweed is almost as good as dung.* Seaweed is extensively used as a manure in maritime districts both abroad and in this country.† In the coastal districts of Scotland and Ireland, and in the Channel and Scilly Islands, it is collected in large quantities and either applied directly to the land—with or without a preliminary fermentation—especially by potato growers; or it is worked up for its high content of potash and iodine either by lixiviation or by burning it and extracting the ash.

Thoroughly dried and powdered seaweed contains as much as 25 per cent. of muriate of potash, most of which can be readily extracted with water. When burnt, the dried material gives from 35-50 per cent. of ash with a potash content (K_2O) of 36-42 per cent.

In Norway, France, Italy, and Japan seaweed is similarly used. It is, however, on the Pacific coast of North America that seaweed, or "kelp," is most extensively used. There, several companies "harvest" the kelp on a commercial scale, and during the War the extraction of potash (and iodine) from kelp was greatly developed. The Bureau of Fertilisers has founded a special experimental station in California for the study of the utilisation of kelp.

Fish Residues, in the form of fish meal, or fish "guano," are too well known as a fertiliser to need more than cursory notice here. It is worth while, however, to note that by the use of fish manure some of the nitrogen and phosphorus lost into the sea as sewage is regained for the land.

Straw.—Before dealing with waste products of purely industrial origin, mention must be made of the utilisation of straw. During the War the increased amount of cereals grown in allied countries resulted in the accumulation of large quantities of straw for which no practical use was available. A process was worked at Rothamsted by Hutchinson and Richards whereby straw can be fermented and converted into so-called "Artificial Farmyard Manure." This product has given very good results in manurial field trials, and it appears to have great possibilities, especially in corn-growing districts, where straw is always plentiful and farmyard manure can only be obtained in sufficient amount by keeping beasts primarily for treading down the straw into manure. The process is now being developed on a commercial scale. It is unnecessary to deal with it in detail here as it has already been described in this *Journal* by the authors of the process.* Essentially the same process has been used for sewage purification,† and the conservation of the nitrogen of sewage The effluent is allowed to flow slowly through a series of straw filters; and the termentation of the straw can go on in the presence of the very low concentrations of nitrogen in the sewage; in actual practice 65 per cent. of the nitrogen was retained. The product after removal from the filter is allowed to go on fermenting for some time. The bulkiness of the straw, and the consequent large size of the installation (it is calculated that 2 lb. of straw are needed per person and per day) are such that the process would be inapplicable to large towns, but for small communities it has distinct possibilities.

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* See *Trans. Highland and Agric. Soc.*, 1898, p. 118; *Jour. Dept. Agr. & Techn. Instr. for Ireland*, Jan., 1914.

† See this *Journal*, Sept., 1910, Vol. 17, p. 458; and Leaflet No. 254.

Industrial Waste Products.—The various waste products of the slaughter house—dried blood, meat meal or "guano," greaves, tankage, etc.—are all well established manures, and it is unnecessary to discuss their manurial value here. Finally there are the waste products of industrial processes to be considered. Among the organic materials comprised in these residues the following may be mentioned.

Brewery and Distillery Residues.—Brewers' grains, if for any reason unsuitable for feeding, and spent hops, are of small direct manurial value, but if obtainable cheaply they can be composted into a manure of some value for its physical effects. Vinasse, the residue from distillation of spirits, is used for feeding purposes, but the vinasse of molasses is rich in potash, and is worked up commercially for the preparation of potash salts.

Tannery Residues.—Waste tan is liable to be harmful to plants if applied to the soil in a fresh condition owing to its content of tannin, and in any case it is of little direct manurial value. After composting for a year or more, however, it is a useful material for lightening the texture of the soil, and finds some application in horticulture for this purpose or for mulches and hot-beds. It is also used for mushroom culture. Hide parings and the sludge that settles out in the steeping vats, often contain appreciable amounts of nitrogen, and if obtainable cheaply are of distinct manurial value, though on the slow acting side. The sludge is rich in lime and therefore valuable for its physical effect and for sour soils.

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* August, 1921. Vol 28, p. 398.

† E. H. Richards and M. G. Weekes, *Proc. Inst. Civil Eng.*, Engineering Conference, 1921.

Leather Waste, on the other hand, is of little or no value as a manure if derived from tanned hides, as it breaks down in the soil only with extreme slowness. It can be improved by suitable chemical treatment, though this is not carried out to any important extent on a commercial scale. In 1917 a committee of the British Association studied the question of the utilisation of old army boots and it was found that by dry distillation a yield of 23-25 per cent. of crude sulphate of ammonia could be obtained. Soft leather scraps are in a different category. They are quite a useful manure, and are used in some market gardening districts, *e.g.*, in Worcestershire.

Sugar Works Residues.—In view of the establishment of the beet sugar industry in this country, the value of the residues of this industry merits consideration. The tops from the beet, the extracted pulp, and the molasses are all useful feeding stuffs, but the first two can also be used directly as manures, while molasses were used during the War, after suitable treatment, as a constituent of compound manures.

Spent animal charcoal is rich in phosphoric acid and also contains 1.5 to 2 per cent. of nitrogen; it is a useful manure, and has long been used as such on the Continent, especially in the neighbourhood of sugar works.

The calcareous sludge obtained from the filter presses is mainly useful as a source of lime, of which it contains about 20 per cent., together with ½ to 1 per cent. of phosphoric acid. It is a good material for improving the condition of stiff or sour soils.

Oil Cakes.—Oil cakes unsuitable for feeding, such as those of castor oil beans, bitter almonds, belladonna, mustard, contain 1-7 per cent. of nitrogen, and appreciable amounts of phosphoric acid and potash. If applied directly to the soil, this should be done some time before sowing, otherwise seedlings may suffer from fungus attacks. Alternatively, they may be composted.

Wool and Silk Waste—Wool waste or shoddy is a useful manure, containing about 5 per cent. of nitrogen. Satisfactory results have been obtained in experiments at Rothamsted.* Silk waste is fairly rich in nitrogen (8-10 per cent.) but is rather slow in its action.

Hair, Feathers, Hoof and Horn.—These are all very rich in nitrogen (12-17 per cent.) but exceedingly slow in action. They are only suitable for direct use in beds which are laid down for several years, as in vine houses; otherwise they need preliminary treatment to render their nitrogen more readily available.

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* This *Journal*, March, 1918, p. 1087.

Among inorganic residues of industrial processes, *flue dust* from blast furnaces was considerably exploited during the War as a source of potash, then so scarce.* Similarly, flue dust from cement works is fairly rich in potash. A sample recently examined at Rothamsted (from a Swedish source) contained nearly 20 per cent. of potash.

A recent development which may assume considerable importance for greenhouse work is the manuring of plants by carbonic acid gas obtained by purification of exhaust gases from furnaces, etc., or from special generators. This idea originated in Germany, and extraordinary results are claimed from experiments carried out in that country. The method is now being tried by some hot-house growers in this country

In this short article it has not been possible to give more than a cursory account of the more important aspects of the use of waste products in agriculture, more particularly for manurial purposes The reader desirous of studying the subject in more detail is referred to Professor Bruttini's monograph. It is to be hoped that the stimulus given during the War to the study of this subject will not be wholly lost in time of peace, and that more attention will be paid to the question of preventing the loss of the incalculably large amounts of manurial elements in waste products of various origins, which occurs at the present time.

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THE PREVENTION OF "BUNT" IN WHEAT.

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ON previous occasions we have published in this *Journal*† the results of experiments in the prevention of " bunt " in wheat. These experiments have shown that formalin,‡ used at the greatly diluted strength of 1 part of formalin to 480 parts of water (=1 pint formalin to 60 gal. water) and applied at the rate of 2 gal. of the diluted solution to the sack (of 4 bushels), entirely prevents "bunt," and, unlike the "pickling" method with "bluestone" (copper sulphate), does not appreciably affect the germination of the wheat. The formalin method is simple, negligible in cost, and the labour involved is not greater than that of the customary "pickling" process when "bluestone" is used. Objections have been raised against the formalin method of treatment on the ground that the volume of solution used wetted the grains so much that difficulty might be experienced in drilling the seed, although farmers who have actually employed the method find no difficulty in this connection. Laboratory experiments had shown that 2 gal. of solution to the sack was necessary to ensure the thorough wetting of the seed and was therefore recommended. It was realized, however, that a lower rate, if equally efficient, might be desirable; and the object of the experiments described below was to ascertain whether a smaller quantity of the formalin solution than 2 gal. to the sack would suffice. Experiments were therefore made during 1922-23 using the formalin solution at the rate of 2 gal., 1½ gal., 1 gal. and ½ gal., respectively, to the sack. The seed wheat used was artificially contaminated with the "bunt" fungus, a large quantity of whole "bunted" grains being crushed in a mortar, and the mass of liberated *spores* being then well mixed into the heap of seed corn—enough spore-material being added to coat each grain and to darken its tuft of hairs. On taking out a handful of the contaminated seed corn, the palm of the hand became darkened with the spores of "bunt." As the results given below demonstrate, this method of contamination was entirely adequate, the untreated plots giving as high a percentage of "bunted" ears as 78. The comparative value of the differing quantities of formalin solution was therefore severely tested in a satisfactory manner.

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* This *Journal*, February, 1915, p. 1053; August, 1917, p. 526.

† Vol. 27, p. 1013 (1921); vol 29, p. 722 (1922).

‡ Formalin is the trade name for a 40 per cent. solution of the gas formaldehyde in water. Purchasers should obtain a guarantee that the formalin sold is of the above strength and should see that it is a clear solution free from any precipitate. Formalin needs to be kept in a tightly closed bottle, and only freshly prepared diluted solutions should be used, as the gas is volatile.

Description of the Experiments with Formalin.—About two pints of "bunted" grains (obtained from the previous year's experimental plots) were crushed with a pestle and mortar and well mixed up with 1½ bushels of Red Standard seed wheat. Ten separate gallons of this contaminated seed were measured out, and five of them labelled A1, B1, C1, D1 and E1, respectively; to each of the other five gallons 90 c.c. (equivalent approximately to 2 per cent. by volume) of whole "bunted" grains were added, and these were labelled A2, B2, C2, D2 and E2, respectively.

The ten lots of contaminated seed were treated as follows, the solution used being 1 part of formalin in 480 parts of water (*i.e.*, at the rate of 1 pint formalin to 60 gallons of water):—

A1 and A2 each received ½ pint solution, = 2 gal. per 4 bush.
B1 „ B2 „ „ ⅜ „ „ = 1½ „ „
C1 „ C2 „ „ ¼ „ „ = 1 „ „
D1 „ D2 „ „ ⅛ „ „ = ½ „ „
E1 „ E2 controls (untreated).

The method of treatment adopted was as follows: each gallon of seed wheat was spread out on a slate slab, then sprinkled with the allotted volume of the solution and shovelled into a heap; the seed was then again spread out and shovelled up twice; when the heap was thus made a third time the wetting treatment was considered complete. Each lot was then covered with a sheet of cloth moistened with the diluted formalin solution and left for four hours; at the end of that time the seed was spread out to dry in a layer about 1 inch deep.

The seed was sown* on the respective plots on 21st November, 1922, the day following treatment, the rate of seeding being about 3½ bushels to the acre. In order to reduce the chances of any re-contamination of the treated seed the plots were sown in the following order:—A1, B1, C1, D1 (at this stage the hands of the person sowing the seed were washed with the diluted formalin solution), A2, B2, C2, D2, E1, E2; the plots were then raked over in the same order.

Samples of the treated and untreated seed were sent to the Official Seed Testing Station on the day the plots were sown. The report received gave the percentage of germinating seed as follows:—

Volume of solution used to sack (4 bushels) of seed.	Sample.	Germination. Per cent.
2 gal.	A1	97
	A2	97
1½ gal.	B1	97
	B2	97
1 gal.	C1	96
	C2	96
½ gal.	D1	98
	D2	97
Untreated	E1	96
	E2	98

The uniformity of the results shows that the treatment with the diluted formalin solution, even when used at the rate of 2 gal. per sack, does not adversely affect germination in laboratory tests.

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* As on previous occasions, Mr. P. Oglesby kindly sowed the plots by hand, and we desire to express our thanks for his assistance.

The relative positions of the ten plots are shown in the plan given in Fig. 1. A very good " plant " was obtained on all the plots. As the crops approached maturity, there was a striking contrast in the general appearance of the plots A1 and A2 and the control plots E1, E2, the plants of the former being taller and of a more healthy colour than those of the latter, which were obviously seriously affected in growth by the great prevalence of " bunt." In August, 1923, the crops were cut and made into sheaves in the usual way. Later, the sheaves were untied and a handful was taken from each so as to make one sheaf from each plot containing samples from various parts of the plot. The ten sheaves (*i.e.*, one from each plot) obtained in this way were carried to the laboratory; 1,000 ears (in ten lots of 100 each) were cut at random from each sheaf and the number of " bunted " ears present in each lot was ascertained.

The following Table gives the results obtained :—

Table showing the Number of " bunted " ears per 1,000.

Lots of 100 each.	A1. 2 gal.	B1. 1½ gal.	C1. 1 gal.	D1. ½ gal.	E1. Control (untreated).
1	1	3	19	65	81
2	1	0	25	80	89
3	0	1	20	78	78
4	0	0	9	61	68
5	0	1	11	79	71
6	0	0	9	73	88
7	0	1	20	78	78
8	0	0	23	62	77
9	0	0	19	39	80
10	0	5	13	54	76
1,000	2	11	168	669	786

Lots of 100 each.	A2		C2.	D2.	E2.
1	0	2	37	77	82
2	1	0	29	57	79
3	1	4	24	60	88
4	0	0	29	80	76
5	0	2	39	79	85
6	1	4	16	74	64
7	0	0	26	64	76
8	0	0	13	55	75
9	0	1	20	66	82
10	1	1	35	54	76
1,000	4	14	268	666	783

It will be seen that the plots, the seed for which had received the same treatment (A1, A2; B1, B2, etc.), agree very closely as regards the numbers of "bunted" ears, with the exception of C1 and C2. On the whole, however, it appears that the presence of the 2 per cent. of "bunted" grains added to the seed did not materially affect the result of the treatments, and the pairs of plots may therefore be considered as duplicates in estimating the percentage of "bunt," as given in the following Table:—

Plots.		*Rate at which the formalin solution was used.*		*Average of "bunted" ears, per cent.*
A1, A2	...	2 gal. per sack (4 bush.)	...	0·30
B1, B2	...	1½ " " " "	...	1·25
C1, C2	...	1 " " " "	...	21·80
D1, D2	...	½ " " " "	...	66·75
E1, E2	...	untreated (control) ...	...	78·45

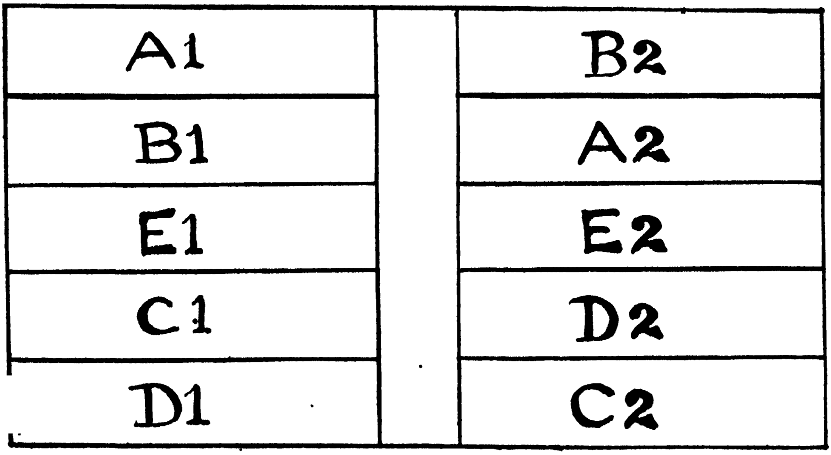

FIG. 1.—Showing position of the Plots.

It is clearly shown by the above figures that the amount of liquid required to disinfect properly each grain in a sack (4 bush.) of wheat, by the method adopted and described above, is 2 gal., the amount mentioned in our previous communications. Using 1½ gal. to the sack a very fair control of "bunt" is obtained, but used at the rate of 1 gal. to the sack the amount of liquid is clearly insufficient to disinfect properly each grain, with the result that over 21 per cent. of ears may become "bunted." It is reasonable to suppose from the figures obtained that the fungicidal action of the formalin solution is dependent upon the dissolved formaldehyde gas being brought by the water into close contact with the fungus *spores*.

Incidentally, the facts obtained suggest that where the "traditional" method of "pickling" wheat with copper sulphate solution has been used by the farmer, in which only 1 gal. of the solution has been used to the sack (4 bush.), the results have been the escape of a large percentage of the grains from (1) disinfection of the " bunt " spores, and (2) death or injury to germination-capacity from the injurious effects of the copper sulphate solution on the grains.

Formalin and Copper Sulphate Compared.—The following field experiment, carried out on the College Farm at Wye, where formalin solution and copper sulphate solution were used, may be mentioned here.

The seed wheat (variety Yeoman) was treated on 9th November, 1922, some with formalin and some with copper sulphate, for direct comparison as to the effect on germination under field conditions. Three sacks of seed were dressed with formalin, diluted at the rate of 1 pint to 60 gal. of water, using 2 gal. per sack, and three sacks of the seed were dressed with copper sulphate dissolved at the rate of 1 lb. to 1 gal. of water, using 1 gal. of the solution to the sack.*

The seed was spread out on a floor, sprinkled with the solution and then shovelled into a heap; it was spread out and again shovelled up twice; when spread out and made into a heap the third time the mixing was considered to be complete. In the case of the formalin-treated seed the heap was then covered with sacks (which had been soaked in the formalin solution), left for 4 hours and then spread out to dry. The seed treated with the copper sulphate solution was, on the other hand, spread out at once to dry. Owing to adverse weather conditions the seed was not sown until four days later (13th November). The field was divided into four plots; two were sown with the formalin-treated seed, the other two with the copper-sulphate-treated seed. The rate of seeding was 3¼ bushels to the acre. On the day of sowing samples were sent to the Official Seed Testing Station; the following report on the germination was received, the figures giving the percentage of germinated seeds.†

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* This is the " pickling " method in common use in this country.

† Mr. C. B. Saunders, of the Official Seed Testing Station, commented on the results as follows :—" Your numbers 1 and 2, *i.e.*, the untreated and the formalin-treated, can be considered to have the same final germination, since the No. 2 might have reached 99 per cent. if we had left it on two days longer. It had germinated 97 per cent. on the fifth day, and we then discontinued the test. No. 1 did not reach 99 per cent. till the seventh day. This was in part due to the fact that one of the pots got rather dry, but apart from this I do not think it was as quick off the mark as your No. 2. The behaviour of No. 3 was quite different. It averaged 63 per cent. in five days, 73 per cent. in seven days, and went on germinating slowly till the eighteenth day, when we discontinued the test. It is possible that it might have done one or two per cent. more. We always find that copper sulphate retards germination."

		5 days.	7 days	11 days.	15 days.	18 days.
No. 1.	Untreated	88	99	—	—	—
No. 2.	Formalin-treated ...	97	—	—	—	—
No. 3.	Copper-sulphate-treated	63	76	81	87	90

Some of the seed was kept until 30th November (three weeks after treatment) when samples were again sent to the Seed Testing Station.

The report showed the germination to be as follows:—

	5 days.	6 days.	7 days.	10 days.	12 days.	14 days.
No. 1 ...	96	98	—	—	—	—
No. 2 ...	97	—	—	—	—	—
No. 3 ...	67	—	77	84	87	92

On 14th December the field was examined; the plants from the formalin-treated seed were about 1½ in. high and it was estimated that, in appearance, they were 3 or 4 days ahead in growth compared with those from the copper-sulphate-treated seed. This difference in growth was maintained for some weeks. but ultimately the plots were indistinguishable as regards growth. Equal portions of the differently treated plots were harvested and thrashed separately; but no appreciable difference in yield was found.

The points of interest in the above field experiment are the delayed germination of the seed treated by "pickling" with copper sulphate, and the corresponding retardation of the appearance of the young plants above ground, thus lengthening the critical period when the seed is liable to attack by birds and other enemies. In this particular case the copper sulphate delayed germination and killed from 6 to 9 per cent. of the seeds. Cases have come to our notice* where the damage caused by the copper sulphate treatment has been considerably greater than this, 40 per cent. of the seed having been killed; and these facts suggest that high rates of seeding, to compensate for this damage, may have become customary.

Summary.—The following method of treatment is a certain preventive against "bunt" in wheat, and does not injure the germination of the seed, so that no increase in the proper rate of seeding is necessary:—

(1) The seed in a heap is sprinkled with diluted formalin solution (1 pint formalin in 60 gal. water = 1 fluid oz. to 3 gal. water). *Two gallons of the solution must be used to every sack (4 bushels) of wheat.* The seed is shovelled over and over until all the grains are wetted; the solution must not be allowed to form pools under the heap in which the grains might soak.

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* See this *Journal*, Vol. XXVII, Feb., 1921, p. 1016.

(2) The heap of wetted seeds is covered over *for four hours*, not longer, with sacks which have been soaked in the diluted solution ; the sacks should be uniformly wet but not dripping.

(3) The heap is then spread out to dry in a thin layer on a clean floor. If the floor has previously been used for untreated wheat it should be wetted all over with the diluted formalin solution and allowed to dry before the treated seed is spread on it.

(4) Precaution must be taken *to prevent the re-contamination* of the treated seed, *e.g.*, sacks which have held untreated contaminated wheat must not be used for the treated seed unless they have been soaked in the diluted formalin solution or boiled in water.

(5) The treated seed when dry should be sown *as soon as possible*.

The above method is as easy to use as the old " pickling " method with bluestone, it is also cheaper.*

At the present time (at any rate in the south of England) something like 50 per cent. of the samples of English wheat on the market are contaminated with " bunt." A certain, simple and safe remedy against " bunt " is now available in the diluted formalin treatment. When all farmers use it, English wheat will be clean.

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THE COMMON CAUSE OF FAILURE OF SPRING OATS—FRIT FLY.

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Many farmers will remember the year 1922 as a particularly bad season for spring oats. April of that year was very cold and, as a consequence, oats made very little growth by the beginning of May.

Previous observations have shown that spring oats which have not made good growth before the first week in May usually suffer badly from attacks of the frit fly maggot. This occurred in 1922, when, as a result of frit fly attack, the average yield per acre in the eastern counties was probably well under four quarters. In addition many fields were ploughed up, and some fields which were undersown were cut for hay. The bushel weight was also very low owing to the attack of the second brood of maggots. One sample of oats from Norfolk examined by the writer contained nearly 60 per cent. of empty " seeds," the grain (or kernel) having been eaten by the frit fly maggot. This sample weighed under 24 lb. per bushel.

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* The cost of material for treating a sack of wheat, with formalin at 2s. 6d. a pint, is 1d.

The oats on the University Farm sown on 16th and 17th March on strong soil in good condition gave the following results :—

Oat Variety Trials, 1922.

Variety.	*Strength of Straw.*	*Sacks Head at 168 lb.*	*Sacks Tail at 168 lb.*	*Total Grain Sacks.*	*Total Straw cwt.*	*Bushel weight. lb.*
Supreme ...	Short, moderate	8.8	0.92	9.7	28.1	31
Yielder ...	Poor	10.0	1.37	11.4	33.4	30
Bountiful ...	Good	7.35	1.11	8.5	34.2	31
New Abundance	Poor	9.93	1.47	11.4	35.2	30
Victory ...	Good	8.8	1.60	10.4	36.0	33
Castleton Potato	Good	5.7	2.1	7.8	42.1	31
Black Tartarian	Good	5.3	2.2	7.5	31.6	28

This indicates that both poor tillerers like Black Tartarian, and extremely good tillerers like Castleton Potato, may suffer severely from attacks of the frit fly maggots.

Experiment on Dates of Sowings.—In 1923 an experiment was arranged to demonstrate that the date of sowing plays an extremely important part in determining the yield of spring oats. On a gravel field on the University Farm, plots measuring about one-twentieth of an acre were marked off. These received superphosphate 3 cwt. per acre, kainit 2 cwt. per acre, and the day before sowing each plot received sulphate of ammonia at the rate of 1¼ cwt. per acre.

The variety used was New Abundance, the seed having been grown on the University Farm the previous year. The seed was sown by hand in furrows about a foot apart, drawn out with a hoe, and the soil then raked level.

Plot 1 sown 1st February ; soil in good condition. 3 bushels per acre. Plants showing through 23rd February.

Plot 2 sown 20th February. (Too wet for sowing on the date arranged, 15th February.) Soil was rather wet for sowing on 20th February. 3 bushels per acre. Plants showing through 18th March.

Plot 3 sown 1st March on a good tilth. 3 bushels per acre. Plants showing through 24th March.

Plot 4 sown 15th March on a good tilth. 3 bushels per acre. Plants showing through 3rd April.

Plot 5 sown 23rd March on a good tilth. 4 bushels per acre. Plants showing through 7th April.

Plot 6 (Half plot). Sown 31st March on a good tilth. 4 bushels per acre. Plants showing through 12th April.

Plot 7 (Half plot). Sown 14th April on a good tilth. 4 bushels per acre. Plants showing through 29th April.

Results.—As the season advanced it was obvious that the yields of the plots would show great differences. An examination of the plots on 12th May showed that the first three were almost free from frit fly eggs, whereas eggs were found on every plant examined in Plot 7. On the other plots the number of eggs were fewer as the age of the plants increased. A careful examination of the plots was made on 28th May to determine the extent of the frit damage.

The earliest Plots (1, 2 and 3) showed only a very small percentage of attacked shoots, and most of these were damaged by wireworms or caterpillars. These plots showed very few late tillers.

Plot 4 showed a moderate attack, about one-third of the shoots being attacked.

Plot 5 showed a larger percentage of attack than Plot 4, but owing to the extra seeding (4 bushels per acre instead of 3 bushels) the number of healthy shoots was very similar.

On Plot 6 every plant was attacked, but a few healthy shoots were present on many of the plants. The number of ears was about 30 per cent. of those on Plot 1.

On Plot 7 every plant was badly attacked, and only a small percentage of healthy shoots remained. Most of the plants were badly stunted. The number of ears was about 10 per cent. of those on Plot 1.

The following table shows the yield of straw and grain :—

	Date of Sowing.	*Yield per acre in cwt.*	
		Grain.	*Straw.*
Seeded at 3 bushels per acre.			
Plot 1	February 1st	16.0	42.7
,, 2	,, 20th	14.9	31.0
,, 3	March 1st	15 2	29.3
,, 4	,, 15th	10.7	25.1
Seeded at 4 bushels per acre.			
Plot 5	March 23rd	9.9	25.3
,, 6	,, 31st	6.2	18.1
,, 7	April 14th	2.0	8.8

These figures indicate that the date of sowing has a great effect on the yield of spring oats. The oats sown on 1st March, or earlier, gave a good yield for the type of land (gravel) on which they were grown; those sown later in March gave rather a poor yield, while those sown at the end of March and in April gave extremely unprofitable yields. It should also be noted that the yield of straw gets less as the date of sowing gets later The plot sown on 1st February gave a particularly good yield of straw, whilst the yield of the plot sown last was extremely low. A slightly later sowing on a headland near by gave even poorer results.

The differences in yield due to date of sowing will vary with the season, and also according to the type of land, but on all soils, even the very best, in any year there is usually a big difference between early-sown and late-sown spring oats. On many farms it is extremely difficult to get a tilth early in the season—in February and early March In cases like these when spring oats cannot be sown early, it is probably more profitable to grow very few spring oats and to get these in at the first opportunity; but for the later sowings, to substitute some other crop, such as barley, which is not likely to suffer much from an attack of frit fly. Many farmers know that late-sown spring oats in the south of England are not an economic proposition, but there are still a large number who do not realise that indirectly the date of sowing of spring oats is one of the most important factors in determining the yield. Winter oats, when they are a good plant in April, do not suffer much from damage by frit fly except in very abnormal seasons. Like wheat, however, they may suffer badly from frit fly attack in February and March if they are sown after a ley containing grasses ploughed up after harvest. Acknowledgment is made to Mr. S. G. Jary for his assistance in making the above observations.

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DODDER AND ITS REMOVAL FROM CLOVER SEED.

C. B. SAUNDERS.

IN this *Journal* for April, 1923, appeared an article, based on an inquiry made by the Ministry, on the "Prevalence of Dodder in Great Britain." The result of the inquiry, which dealt mainly with evidence from the field, showed that there was no apparent increase of dodder in this country. No distinction, however, was made between the different forms of dodder, and the present note, based on the records of the Official Seed Testing Station, is put forward in partial amplification of that article.

The Station records have been examined in so far as they relate to the occurrence of dodder in samples of red clover seed described as "English." The percentage of such samples found to contain dodder in the years 1917-18 to 1922-23 was respectively as follows:—

1917-18	...	24·0	1920-21	...	4·4
1918-19	...	12·1	1921-22	...	10·2
1919-20	...	3·4	1922-23	...	17·6

As might be expected, considerable fluctuation is shown, the presence of the seeds of dodder in commercial samples depending largely on the occurrence of climatic conditions favourable for the ripening of the seed.

The dodder found in red clover samples may for practical purposes be referred to two types—the small seeded form and the large seeded form. The first mentioned is the so-called "English Dodder" (*Cuscuta trifolii*, Bab.) which is indigenous and, under normal conditions, can ripen seed over the greater part of England south of a line from Hull to Liverpool. The term "large seeded dodder" is used to describe the non-indigenous species which occur generally in red clover of European and Chilian origin. These large seeded dodders include two or three closely allied species whose seeds are not easily distinguished from one another, and regarding whose nomenclature there is some difference of opinion. For the present purpose it will be convenient to describe them generally as forms of *Cuscuta racemosa*, Mart. The impression has been held in the past in certain quarters that the forms of *Cuscuta racemosa* do not ripen seed in this country or, at the most, only in exceptional circumstances. The fairly frequent occurrence of *Cuscuta racemosa* in samples sent to the Official Seed·Testing Station as English-grown red clover has caused some doubt to be cast on the accuracy of this theory, and one practical object of this note is to draw attention to a fact which it is suggested is of economic importance.

The records of the Official Seed Testing Station show that in the last four years the percentage of samples described as English red clover which contained the large seeded dodder was 1.2, 2.2, 2.3, and 10.0 respectively. Figures for earlier years are not available. The occurrence of individual cases is easily explained by the fact that samples consisting wholly or in part of foreign seed are from time to time sent to the Station misdescribed as "English." There is no evidence that misdescription of this nature is increasing; in fact the reverse is almost certainly the case, since seed legislation has resulted in greater care and accuracy.

A critical study of the records relating to the 36 samples of English red clover in which large seeded dodder was found at the Official Seed Testing Station during the past season suggests that, though some samples are almost certainly misdescribed, the majority are from bulks once-grown in England from foreign seed containing the dodder. (This practice of applying the description "English Red Clover" to once-grown foreign seed is a matter which demands consideration.)

It is suggested therefore that there is evidence that the forms of *Cuscuta racemosa* can produce seed in this country, and that the figures given above hint at the possibility of the plant gradually acclimatising itself to English conditions by the automatic selection of hardier and early ripening strains. Further, it seems not improbable that, if due attention is not paid to the matter, this pest may become as troublesome in England as it is in some continental countries.

In view of this possibility it is of interest to note that a new process has recently been discovered by which the removal of the large seeded dodder from clover seed is easily effected. The small seeded dodder is only about 0.8 mm. in diameter and can therefore be comparatively easily screened out of red clover, without loss of good seed, by the use of a sieve having holes of 1 mm. diameter—a mesh almost equivalent to a number 5½ sieve. This separation therefore presents no difficulties to the seed cleaner.

On the other hand, *Cuscuta racemosa* is very similar in size to red clover, and consequently its removal has in the past been a matter of considerable difficulty even though the cleaner was prepared to face a considerable wastage of good seed, amounting sometimes in the case of Chilian seed to as much as 25 per cent. of the bulk Such cleaning is laborious and expensive, and materially increases the price of "Dodder-free" seed.

It is worth while therefore to give a brief outline of the process referred to above, which will enable the cleaner to remove *Cuscuta racemosa* as easily and economically as he now removes *Cuscuta Trifolii* by the sieve method. The method, like that of some other cleaning machines, is based on the fact that the coat of a dodder seed is somewhat rougher and less polished than that of a clover seed. Advantage is taken of this in a novel manner. The seed is mixed with a magnetic powder, and more of this adheres to the rough coats of the dodder seeds than to the smooth coats of the clover seeds. The seed is then passed under a magnet which draws out the seeds bearing sufficient of the powder to be magnetically attracted. By this means not only can an absolute elimination of dodder be made, but there are also removed broken seeds whose rough surfaces hold the powder and rough-coated weed seeds such as Cut-leaved Cranesbill. The clover seed is then put through a polisher to remove adhering powder.

The first commercial machine working on the principle outlined above has been in use for six months, and has given remarkably good results, a single treatment removing every seed of dodder from a bulk of Chilian red clover. Apart from its efficiency for removing dodder the importance of the process lies in the very small wastage. The machine has dealt with over 50 tons of seed, and the total cleanings are not much more than half a ton, so that it follows that the amount of good seed removed is negligible.

It is not claimed that the process results in a product free from impurity, but that its importance lies mainly in the fact that it provides a means of removing large seeded dodder from red clover, or in fact any dodder from any clover, with very little waste.

In conclusion, the present position regarding dodder in England can be summarised briefly:—

1. Small seeded dodder (*Cuscuta trifolii*) is probably on the decrease owing to greater attention paid to cleaning. This seed can be easily removed from red clover by screening.
2. Large seeded dodder (forms of *Cuscuta racemosa*) appears to be increasing, and may possibly be gradually acclimatising itself. It cannot be easily removed from red clover by screening, but a new process of magnetic separation seems to offer very great promise of supplying a simple and economic means of overcoming this difficulty.

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COUNCIL OF AGRICULTURE FOR ENGLAND.

THE Eleventh Meeting of the Council of Agriculture for England was held on Thursday, 13th December, 1923, at the Middlesex Guildhall, Westminster. The chair was taken by Sir Douglas Newton, K.B.E., M.P.

Appointments to Agricultural Advisory Committee for England and Wales.—A meeting of the members of the Council representing County and Borough Agricultural Committees was held before the meeting of the full Council, for the purpose of electing two members to serve on the Agricultural Advisory Committee to fill the vacancies caused by the resignations of Lords Aylwin and Bledisloe. It was decided that in the event of more than two candidates being suggested for the vacancies a ballot should be taken, and the first two names in the order of the voting should be declared elected. The names of Lord Aylwin, Lord Bledisloe, and Mr. Harry German, were proposed for the election, the first two on the assumption that they would be willing to be re-elected, having in view the circumstances under which they tendered their resignations. As a result of the ballot Lord Aylwin and Lord Bledisloe were re-appointed.

Meeting of full Council.—The Minister of Agriculture said with regard to the item on the Agenda which indicated that he would make a statement, that there was really no statement which he could make. The Government had placed a policy before the country in which Agriculture was largely concerned, and which they hoped would be very much to the benefit of the industry. The country had decided against it, and, therefore, he did not think he could usefully say anything at the moment.

The Council's Use and Functions.—Lord Clinton moved:—

> "That in order that this Council may be enabled to carry out the duties for which it was appointed, it is essential that opportunities should be given for the discussion of changes in Agricultural Policy before the Government is committed to them."

In his speech he referred also to the ineffectiveness of the Council as illustrated by the Agenda paper for the Meeting. He said that the Council was a thoroughly representative body, but that it had failed in its work. The causes were, he thought, several; it was largely due to its somewhat too close official connection with the Ministry of Agriculture. The Council also met once in 6 months, and it was absolutely impossible to carry on any work effectively with only two meetings per annum. To be effective the Council required to have an Executive or other Committee. He would like to see a Committee of the Council now appointed to inquire in what way the procedure could be altered so as to make its work effective for the industry which the Members presume to represent. *Lord Selborne*, in seconding the motion, said that in his opinion those who suggested that the Council should be abolished were making a great mistake. If the Council were compared with other agricultural bodies, it would be seen that it had advantages which none of them possessed. It represented owners, farmers and labourers, education and research, and minor agricultural industries, as well as being extraordinarily representative in a geographical sense by reason of its County and Borough Agricultural Committee members. He thought it was partly the fault of the members of the Council themselves that the Council had been of such little use, and partly the fault of the Ministry of Agriculture. It was quite true that whatever Ministry was in office, from whatever party it was drawn, the Agricultural Policy adopted by that Ministry would eventually be the policy of the Ministry of Agriculture, for which it would have to be responsible. Instancing the action taken with regard to the importation of breeding stock from the Dominions, he did not question the right of the Ministry or of the Government to adopt that policy if, on the whole, it was thought to be a sound policy, but he did object to the reasons given. The Minister of Agriculture had said that the Council had unanimously given him certain advice, but that he had put that advice aside and had accepted advice given him by the Agricultural Committee of the House of Commons, from what, he understood was the advice of the Royal Agricultural Society and the Stock Breeding Societies. He did not dispute the right of the Minister to set aside the advice of the Council, but he did dispute the right to put another body as a rival authority to the Council.

The Minister of Agriculture said that the Council had been set up by Statute to assist the Ministry in the execution of its powers and duties. It was laid down in the Act that the Council should meet at least twice a year for the purpose of discussing matters of public interest relating to agriculture or other rural industries, and such meetings were to be held in public. The Minister was not a member of the Council, he came only by invitation, and had no power to initiate discussion. The whole of the proceedings were in the hands of the Council itself. At the initial meeting of the Council, Lord Lee had indicated the scope and functions of the Council, which the Minister again outlined. He added that Lord Clinton's motion was one which presented some difficulty in view of the fact that the Minister was not a member and had no power to initiate discussion. There was also the difficulty which everyone realised of publicity. When matters of policy in agriculture or any other Department of State were being considered, it was not desirable to have a full dress debate in public in the early stages. There was also the difficulty of time. Important decisions on agricultural and other matters were often taken in a short time, and the people concerned often pressed for a decision. The deputation from the National Farmers Union, which went first of all to Mr. Bonar Law and then to the present Prime Minister recently, certainly on the second occasion, made a great point of wanting a very early reply. The question of time was a factor which made it difficult to call an extraordinary meeting of the Council before any important decision was taken. Another thing which ought to be borne in mind was that it was not always easy to get Governments to initiate a policy, and if it was known that a policy had to be discussed in public before it was initiated, it was at all events worthy of consideration by the Council as to whether it was not likely that less instead of more might be done. He did not want to influence the decision of the Council one way or the other, but he thought it was his duty to put forward these considerations so that the Council would vote with its eyes open, knowing exactly what it was doing.

Mr. Ashby, Mr. F. J. K. Cross, Mr. R. Bruford, Col. Courthorpe, Lord Bledisloe, Mr. Christopher Turnor, Mr. Dallas, Alderman Davis, and Mr. Spraggon also took part in the debate. Mr. Cross suggested an amendment—

> "That a Committee of this Council be set up to consider and report in what manner the work of the Council may be made more profitable to the interests of Agriculture,"

which was seconded by Mr. Bruford. As a result of the discussion it was agreed that the proposed amendment should be treated as an addendum to the original resolution, which was then carried in the following *terms*:—

> "That in order that this Council may be enabled to carry out the duties for which it was appointed, it is essential that opportunities should be given for the discussion of changes in Agricultural Policy before the Government is committed to them; and that a Committee of this Council be set up to consider and report in what manner the work of the Council may be made more profitable to the interests of Agriculture."

It was decided to set up a Committee of eleven, as follows:—Mr. G. Dallas, Lord Clinton, Mr. Dan Crawford, Mrs. Hugh Middleton, Mr. P. Manwaring, Professor T. B. Wood, Sir Gilbert Greenall, Sir Merrik Burrell, Mr. W. J. Fitzherbert-Brockholes, The Hon. E. G. Strutt, and the Chairman, Sir Douglas Newton.

Summer Time.—Mr. Jas. Hamilton moved the following resolution:—

> "That this Council recommends that in the event of the Daylight Saving Bill being renewed for 1924, it shall operate from the first Sunday in May until the first Sunday of September. If it goes beyond that date, it should continue until the last Sunday in October on account of the potato harvest."

He said that a strong deputation had recently waited upon the Home Secretary, asking that the Daylight Saving Act might be extended and made permanent. What farmers asked was that townspeople should have the benefit of it with as little injury as possible to those engaged in farming, and therefore that the first Sunday in May should be the date of operation and the first Sunday in September the date of its conclusion. With regard to the first date, it should be remembered that for six months the workers engaged on milk-producing farms were engaged in feeding and milking cows in the dark, and the Daylight Saving Act meant throwing them back another month. In the North of England, farmers would like to see Daylight Saving end on the first Sunday in September because that was the harvest month. At whatever time they finished at night they had to start at the same time in the morning, because it was necessary to get the milk away. It frequently meant a 15-hour day. If this proposal was not agreed to, an extension of Daylight Saving to the last Sunday in October would be a benefit to the potato growers, as it would allow them more daylight in which to harvest their crops. He added that October was the only month in the year in which Daylight Saving could be of benefit to the farmer. The motion was seconded by Mr. G. G. Rea, C.B.E. In his speech he pointed out that Daylight Saving affected the arable farmer in haymaking and harvest time in the North of England. There was the extra hour of dew in the morning, which meant that something else had to be done to fill up that hour, and people were asked also to work abnormally long hours in the evening to make up for it. The argument that farmers were not bound to abide by any particular hours was true, but there was a practical objection that it added immensely to the labours of the housewife, who is often the hardest worked person in the community. She would have two time-tables, one for the working members of her family and another for the children going to school. He was strongly of the opinion that Daylight Saving should be discontinued except for the four summer months. If, however, that was impossible, then he thought it should continue to the end of October, because at that particular time of year an hour in the evening was of more value to agriculture than an hour in the morning. In the course of the discussion, in which Lord Bledisloe, Mr. Cross, Mr. Nunneley, Col. Courthope and Mr. Spraggon took part, it was proposed by Mr. Nunneley, and seconded by Lord Bledisloe, that the second part of the resolution should be deleted. The amendment was put to the meeting and lost by 31 votes against 18. The original motion was then put to the meeting and carried.

Foot-and-Mouth Disease.—Mrs. Hugh Middleton then moved the following resolution:—

> "That this Council, while paying grateful tribute to the work of the Ministry of Agriculture in trying to eradicate Foot-and-Mouth Disease in this country, respectfully submits that, in view of the fact that years of strenuous effort on the part of the Ministry has failed to attain its object, it would appear that its policy is based on a wrong principle and should be reconsidered and adjusted on the following lines, viz.: That Foot-and-Mouth Disease continue to be a notifiable disease, but that owners be held responsible for the isolation and cure of their stock on the understanding that the goodwill and expert advice of the Ministry is at their service; and that the policy of slaughtering infected animals be discontinued and therefore no further compensation be paid."

The mover explained that she had raised the matter as she was anxious to throw some light on the problem of the disease. She was first able to make a close study of it in February, 1922, and had offered to give evidence before the Departmental Committee on Foot-and-Mouth Disease which sat in that year. She had been enormously impressed by the care which that Committee had given to their investigation and by the efforts of the Ministry in the eradication of the disease. But the fact nevertheless was that the machinery set up for this purpose did not work. She considered that if the disease were left to the courage, commonsense and perseverance of the British farmer, and, in a policy of isolation rather than slaughter, if use were made of the spirit of goodwill which existed between the Ministry and the farmers, the former giving all the expert advice it could, progress would undoubtedly be made and the disease wiped out. If this course were adopted, no compensation would be necessary as no animals would be slaughtered. In the course of her speech, Mrs. Middleton pointed out that the Committee's recommendations in regard to the proper disinfection of weighbridges, docks, railway trucks, etc., were not being carried out. She also referred to the brutal methods which had been employed in some cases in the slaughtering of animals infected by, or suspected of, the disease. The motion was seconded by Alderman T. Davis, and a discussion followed in which the Minister, Mr. Patterson, Alderman Carter, Mr. McCracken, Mr. Egerton Quested, Sir Merrik Burrell, Mr. German, Mr. Nunneley, and Mr. W. R. Smith, M.P., took part. Mr. Patterson pointed out that clearly in the early stages of an outbreak safety lay in immediate slaughter, and that while this was maintained, compensation must be paid. The only point he wished to raise was whether the time had not arrived when the authorities should seriously consider whether they ought to carry on with the policy of slaughter. The test of any policy was its success or failure, and he was afraid that the Ministry would shortly be driven to the conclusion that the slaughter policy was not successful.

The Minister said he could not allow certain statements which had been made by Mrs. Middleton, though made in good faith, to go forth without a word of protest. There was no ground, he was informed, for any accusation of cruelty. At the same time, he would gladly look into the details of any cases which Mrs. Middleton would give him. With regard to the merits of the slaughter policy, the question was one on which the opinion of the Council would be exceedingly valuable. The experience of those who had tried it was that isolation on a large scale broke down. It was quite true that a pedigree herd could usually be isolated because people who kept pedigree herds had the very best equipment and a fairly ample staff of men; but to isolate in every case with an enormous number of outbreaks was quite impossible. Without slaughter, they would have Foot-and-Mouth Disease always with them. The Government was prepared to adhere to the policy of slaughter up to at least £1,500,000. The Ministry were taking all possible steps to expedite slaughter in the bad areas—Shropshire and Cheshire. The improved measures had had considerable effect in the last few days. He agreed with the mover of the resolution that everything possible ought to be done in the way of investigation and research, and the Government was going to ask the highest medical authority to act in consultation with and to advise the Ministry. Mr. McCracken moved an amendment to the resolution:—

> "That the Ministry of Agriculture be requested to use all the means at their disposal in the direction of research into Foot-and-Mouth Disease, and that meanwhile the Council leave the matter in their hands."

Mr. Nunneley seconded the amendment, giving particulars of the very grave losses which he had sustained in his early farming years. He added that anybody who knew the condition of the herds of the country in the years from 1868 to 1882 would not advise any Minister to do away with the policy of slaughter. The amendment was by leave of the Council withdrawn.

Sir Merrik Burrell then moved a further amendment:—

> "to omit all words after 'respectfully' in the original motion, and substitute the following: 'urges it to continue the policy of slaughter until such time as the Veterinary Authorities recommend otherwise.'"

He stated that this was the sense of the absolutely unanimous opinion expressed at the general meeting of the Royal Agricultural Society on the previous day. Mr. German seconded this amendment, stating that he had been at a meeting at Crewe last week to discuss the question with those who were suffering more than anybody else in England on account of the disease, and after a very long discussion, a resolution was carried leaving the matter entirely with the Ministry to proceed in such manner as it thought best. He suggested that the Minister be asked to place at the disposal of the Press an absolutely impartial memorandum on the whole question, which by the courtesy of the Minister he had read. Sir Meirik Burrell's amendment was then put and carried. It read as follows: —

> "That this Council, while paying grateful tribute to the work of the Ministry of Agriculture in trying to eradicate Foot-and-Mouth Disease in this country, respectfully urges it to continue the policy of slaughter until such time as the Veterinary Authorities recommend otherwise."

Reports. —The Report containing further information as to the Ex-Service men settled on the land in England and Wales which had been laid before the Council was received; also the Half-Yearly Report (No. 6) to the Council of the Proceedings of the Agricultural Advisory Committee for England and Wales, a copy of which is printed below. Mr. Fitzherbert Brockholes suggested on paragraph 10 of the Half-Yearly Report that it would be advisable that four of the eight persons interested in the Milk Industry which were to be appointed by the Minister to the Milk Advisory Committee should be actual producers. At this point, Mr. Robbins raised the question of a successor, and there being found to be not one-third of the members present, the proceedings terminated.

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AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

THE following is the half-yearly report (No. 6) to the Councils of Agriculture for England and Wales, on the proceedings of the Agricultural Advisory Committee :—

The Agricultural Advisory Committee has met six times between the date of the last report, which was issued on the 3rd May, 1923, and that of the present report—viz. : on 6th June, 11th July, 1st August, 10th August, 3rd October and 7th November, and has discussed the following subjects, with the results stated :—

(1) **Stimulation of Urban Interest in Agriculture.** —At the last meeting of the Council, a resolution was passed :—

> "That it is necessary to stimulate on the part of urban and industrial communities greater interest in the development of agricultural England."

This resolution was referred by the Council to the Agricultural Advisory Committee to consider what steps could be taken to give effect to it. The Committee discussed the matter and decided that, in addition to the work which was at present being done by various unofficial organisations, special steps might be taken through the British Empire Exhibition of next year, and the Committee made a recommendation to the Ministry accordingly. Two members of the Committee were eventually nominated to sit on a Committee "to advise the Ministry and to co-operate in the preparation of the agricultural exhibit at the British Empire Exhibition."

(2) **Importation of Foreign Potatoes.**—A resolution was passed at the last meeting of the Council:—

> "That the Government be urged to take steps to avoid disaster to the potato industry of the country."

The Committee was informed that the Government had already announced that it was not prepared to place an import duty on foreign potatoes at the present time, but that the position would be reconsidered if need should arise after this season's crop had been gathered. In these circumstances, the Committee did not think that it could usefully take further action.

(3) **Charges for Licences to sell Certified Milk, &c., under Ministry of Health Order.**—It was reported to the Committee that the Ministry had taken up this matter with the Ministry of Health, but that there appeared to be no prospect of reducing the charges at the moment. It had been laid down by the Treasury that the services of inspection, &c., under the Milk (Special Designations) Order should be paid for by those concerned. Furthermore, the fee for "certified milk" licences was £5, and that that fee was the highest in the scale of charges. So far, no more than 50 licences for the sale of this class of milk had been issued, and the holders of these who sold the milk at 6d. a pint would very soon recoup themselves for the cost of the licence. It was pointed out that the new Order setting out the charges would have to be laid before Parliament for a period during which objections to it might be taken, and that in the circumstances, the matter was one which might very properly be raised in debate in either House.

(4) **The Grant of £850,000 for Agricultural Education and Research.**—The question of supplying Sparsholt Farm Institute with a new Hostel at an expenditure of £14,000, of which three-quarters would come from the Fund, was considered. It was suggested by the Committee that a limit of £10,000 should be fixed, subject to the Ministry making any small increase later, if such a course were found to be necessary.

The point was raised in Committee as to whether, in view of the fact that the Fund was not guaranteed after March, 1927, certain scientists who were working under it might, unless they were assured of continuance of service after that date, relinquish their work in favour of more permanent posts elsewhere. It was stated on behalf of the Ministry that although in the nature of the case no absolutely definite undertaking could be given, there was not any reasonable room for doubt that the Government in 1927 would uphold the undertaking which had been given by the Treasury that schemes started out of the fund recently placed at the disposal of agricultural education and research would continue to be maintained after 1927.

(5) **The Proposed Tax on Imported Malting Barley.**—The Committee considered correspondence between Government Departments which showed that unforeseen difficulties had arisen in the way of levying an Excise duty on malting barley, and decided to leave the matter in the hands of the Ministry to make the best arrangement possible in the circumstances. Later, alternative schemes were discussed and recommendations made. At a meeting on the 3rd October, however, the Minister informed the Committee that a Departmental Committee was being set up to consider the various methods which had been suggested of levying a Customs duty, not an Excise duty, upon imported malting barley and to report what in their opinion is the

most convenient form of duty. The Advisory Committee asked that the Departmental Committee might be requested to report as soon as possible.

(6) **Imperial Economic Conference.**—At the meeting on the 11th July, the Committee considered various memoranda circulated in connection with the items of the preliminary agenda for the Imperial Economic Conference. It was agreed at this meeting that a separate small Advisory Committee should be appointed for the purpose of advising on all agricultural questions which would or should be brought up at the Conference. Five members from the Agricultural Advisory Committee were nominated for this purpose (viz., Lord Bledisloe, Mr. McLaren, Mr. Robbins, Mr. W. R. Smith and Mr. C. D. Thompson), with power to co-opt two representatives of the Agricultural Committee of the House of Commons (Mr. Pretyman and Mr. Percy Hurd were subsequently appointed), and, later, Sir Merrik Burrell, of the Livestock Defence Committee.

This Sub-Committee considered memoranda and advised on several matters, including Imperial Agricultural Policy and Imperial Preference, Overseas Settlement, Importation of breeding and store stock from Canada and the Dominions. It also had unofficial meetings with representatives of Dominion Agriculture who came to this country in connection with the Economic Conference.

(7) **Report of Agricultural Machinery Committee.**—A Memorandum was circulated stating and discussing the principal recommendations of this Committee. from which it appeared (1) that the Ministry could not undertake to carry out machinery research direct, (2) that before any progress could be made a centre for the new Agricultural Machinery Research Institute, which the report proposed, had to be decided upon, (3) that the Ministry had selected Oxford as the best centre for the Institute. The Committee discussed this choice and some of them were in favour of Cambridge as the centre. It was stated, however, that the Ministry was now fairly definitely committed to their offer to Oxford and could hardly withdraw it. It was finally agreed that the Committee should ask the Ministry to reconsider the whole matter if it proved, on further enquiry, that the present negotiations with Oxford had not gone too far for this to be done.

(8) **Importation of Breeding Stock.**—Lord Ailwyn at the meeting on 1st August brought before the Committee the following resolutions which had been passed by the Council of the Royal Agricultural Society:—

> "That this Council is strongly opposed to the suggested importation of breeding stock from other parts of the British Empire."
>
> "That the Council of the Royal Agricultural Society of England strongly protests against any renewal of the practice of giving pledges at the Imperial Conference to the detriment of British Agriculture, without either the knowledge or consent of Parliament or British agriculturists."

Mr. McLaren also brought before the Committee the following resolution which had been passed by the Shorthorn Society:—

> "The Council of the Shorthorn Society deplores the action of the Government in proceeding to the preparation of an Order for the admission of breeding cattle from Canada before having fully ascertained the opinion of all those primarily interested in the breeding of cattle in

this country, and before experience has shown the effect of the admission of store cattle. The Council is of opinion that the admission of bulls is indefensible, and that there is at present no shortage of breeding females such as alone could justify the precipitation of the Government is preparing this fresh Order, especially at a time of crisis in agricultural affairs for which no effective remedy has yet been suggested. The Council is of opinion that should the Government unfortunately determine to put the Order in force no advantage would be gained by stipulating for an abortion test, and that if there is to be a test for the detection of tuberculosis its precise nature should be clearly defined."

The subject of these resolutions was discussed. It was pointed out that the Importation of Animals Act passed last year had made provision for the admission of breeding stock, and that, therefore, the question to be settled was rather on what terms they ought to be admitted than whether they should be admitted at all. The Committee, however, after further discussion passed the following resolution :—

> "That this Committee is strongly opposed to the suggested importation of breeding animals from other parts of the Empire."

It was understood that this Resolution was a re-statement of the Committee's views upon the matter, but would not, if the Government decided that there was no other course but to make the Order proposed, debar the Committee from expressing an opinion on the terms of the Order. It was also decided that a special meeting of the Committee should be convened at an early date, to discuss the whole situation in regard to the importation of breeding and other cattle.

At the special meeting, the Minister referred to the resignation from the Committee of Lord Bledisloe, which had taken place over the question of the admission of breeding stock because of the confliction which His Lordship felt between his duty as a member of the Council of the Royal Agricultural Society and that as a member of this Committee. As a result of a careful consideration of all the circumstances, the Advisory Committee came generally to the conclusion that they saw no reason to depart from the views which they had expressed at the last meeting. At the special meeting the Committee had the benefit of the assistance of Sir Merrik Burrell, who had been invited to attend. The Minister intimated that he saw no alternative but that the Government should proceed on the lines of allowing reciprocal importation of pedigree stock between the Dominions and the United Kingdom.

The resignation of Lord Ailwyn was laid before the Minister at the next meeting of the Committee, when the Minister expressed the regret which the Committee felt at the resignations of both Lord Ailwyn and Lord Bledisloe over the question of the importation of breeding stock.

At the meeting on 7th November, the Minister reported to the Committee that it had been agreed at the Imperial Economic Conference that the matter should be proceeded with on the lines of reciprocal arrangements for the admission of pedigree stock, and that, with regard to store stock from Canada, the difference between the accepted meaning of fat and store stock should be defined as accurately as possible.

(9) **Foot-and-Mouth Disease.**—At the meetings of the Committee on the 3rd October and 7th November reports were made as to the position and prospects in relation to the disease; which were considered and discussed by the Committee.

(10) **Milk Advisory Committee.**—The recommendation in Lord Linlithgow's Committee's Report on Milk and Milk Products for the appointment of a Standing Milk Advisory Committee was considered, and it was agreed that the Committee should consist of official representatives, with eight persons interested in the milk industry to be selected by the Minister.

(11) **Agricultural Conference at the British Empire Exhibition.**—The Committee agreed that the Ministry should obtain the views of the National Farmers' Union and the Royal Agricultural Society on a proposal to hold an agricultural conference at which administrative and technical agricultural questions should be discussed.

(12) **Proposed Subsidy to Arable Agriculture.**—The Committee at their meeting of 7th November discussed the letter from the National Farmers' Union on the position of arable agriculture, which the Minister had transmitted to the Prime Minister and which would shortly be considered by the Cabinet. Certain views were voiced by members, but it was agreed that the Committee would not at this stage express an opinion on the suggestions in the letter but would if required by a Cabinet Committee submit them, covering points of detail, at a later date.

(13) **Power of County Councils to make Restrictive Regutions on the Movement of Animals.**—The position in this matter was considered and the question raised as to whether the old Order of the Ministry which gave the Local Authorities this power should not now be modified so as to require them to get the Ministry's approval to draft orders before issue. The Committee agreed that that appeared now desirable but the matter was adjourned for certain further information.

(14) **Report of the Proceedings of the Various Advisory and Departmental Committees set up by the Ministry.**—One report was received by the Committee under this head in the period under review. It was dated 24th July, 1923, and dealt with the proceedings of the Agricultural Prices Committee, the Tribunal of Investigation into Agricultural Conditions, the Agricultural Meteorological Conference, the Basic Slag Committee, the Electro-Culture Committee, the Agricultural Research Council, the Conference of Advisory Officers, the Advisory Committee on Agricultural Science, the Methwold Management Committee, the Allotments Advisory Committee, the Warble Fly Committee, the Central Scholarships Committee, the Horticultural Advisory Committee, the Poultry Advisory Committee, and the National Poultry Institute Advisory Committee.

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TURKEY REARING ON LIMITED AREAS.

E. T BROWN.

AN impression which is firmly fixed in the mind of the modern poultry-keeper is that it is essential to have unlimited space for turkey raising. This belief, like many another founded upon the paucity of one's knowledge, has now been exploded, and it has been proved that turkeys can be raised equally successfully on a limited area of land as when given a free range.

The one thing lacking in the past was to discover a system which would bring about the desired results. That such a system could be found was indicated by the enormous advance that has been made in the production of eggs from ordinary fowls. Twenty years ago winter eggs were few and far between; to-day tens of thousands of pullets and hens lay throughout the cold weather. This has been rendered possible, not altogether by breeding, but principally by the alterations that have taken place in management. Early hatching, the provision of a scratching-shed for use in bad weather, a method of feeding that encourages the birds to take exercise. the judicious use of animal foods, such as meat meal and fish meal, and artificial illumination of the house during the dark evenings, have conjointly made the winter-egg yield almost equal to that of spring and summer. The great influence of management is an undisputed one.

The only reason why a system of rearing turkeys on small areas has not been generally practised hitherto is that the average poultry-keeper is conservative to a degree, and firmly believes that wide liberty for the birds is essential to success. Being convinced on this point he has never troubled to give the matter a second thought.

A System That Works.—One of the most successful turkey raisers I know only possesses a total of 3½ acres of land, of which close upon 3 acres is woodland. The soil is medium to light, naturally well-drained, and the district is a kindly one as regards climatic conditions. These are, of course, contributory factors, and without them results would not be nearly so good.

The best breed for the purpose is the Cambridge bronze. A very important point is to rely upon fully matured birds for the breeding pen. The hens should not be less than 3 years old; the stags 2 or 3 years of age. The male, too, must be un related to the hens. In-breeding weakens the stamina and undermines the constitution.

The breeding flock is boarded out from June to February on a neighbouring farm. This is not an essential part of the system, but when it can be done it is an advantage. The pen is brought in at the beginning of February, so that the birds can grow accustomed to their surroundings before the laying season approaches. The breeding birds are housed in a large open-fronted shed, each bird being allowed 12 sq. ft. of floor space. This house is placed at one end of a wire-netted run 100 ft. long by 18 ft. wide. The run is planted with fruit trees, which help considerably to keep the ground pure and sweet.

Turkey hens do not like to share a nest with other birds. The necessary number of crates, with a sufficiently large hole cut in one end, should be dotted about the run. Each hen will select a nest for herself and stick to it throughout the laying period. The nests should be visited every day and the eggs removed.

Feeding the Breeders.—As a grain ration the breeding birds are fed upon oats (2 parts) and wheat (1 part), this being given half in the morning and half in the late afternoon. For the remainder of the day they are supplied with dry mash in a self-feeding hopper. Any good dry mash that is employed for ordinary laying hens answers admirably. If soured milk or soured skim milk be available, the meat meal or fish meal should be omitted from the dry mash. If either of these can be obtained, it should be given at midday at the same time as a liberal supply of succulent green stuff is fed. On no account should the green food be omitted.

A supply of grit, oyster shell and granulated vegetable charcoal should always be before the birds. To keep the digestive troubles which are always lurking round the corner of every turkey house in their proper place, these three items should not be allowed to run short.

Hatching the Eggs.—As the eggs are laid they should be placed under reliable hens for incubation. A large hen will cover a dozen turkey eggs easily, but it is better to limit the number to eight or ten. Removing the eggs encourages the turkey hens to lay a larger number; if one should show signs of broodiness she can be broken in the usual way even more easily than can a general-purpose breed fowl. During the last four or five days of incubation the eggs should be damped with warm water just before returning the sitting hen to her nest.

It is advisable to set a number of hens at the same time. When the hatches are all completed the best hens should be chosen and each one given 20 to 25 turkey chicks to mother. These hens can be placed in double coops, but a better plan is to employ a brooder house divided into compartments 2 ft. wide with long open runs of a similar width in front. Each section accommodates a hen and her brood for the time being.

By the time the youngsters are a month old they are too large to nestle under the hen, but they still require looking after. The partitions in the brooder house are, therefore, taken away and three or four batches of turkey chicks are given to one hen —the best for mothering purposes—and allowed the run of the whole brooder house. The partitions, too, in the runs are removed, thus giving one run ¼ acre in size.

The youngsters remain in the brooder house until they have " shot the red." As soon as this period has been passed successfully the young turkeys are taken to the woodland run. This is about 8 acres in extent and fenced with 6 ft. netting. The birds are housed in open-fronted sheds, but whenever the weather is at all fine the birds prefer to sleep in the branches of the trees. The provision of sheds is, however, essential in case of bad weather.

Importance of Correct Feeding.—The system of feeding adopted during the early days is of great importance. The following is the plan adopted by the breeder referred to above :—The hen requires a good feed of wheat and oats both morning and afternoon for the first three weeks; this is taken for granted. When the brood is two days old a little wet mash, consisting principally of soaked biscuit meal and Sussex ground oats is supplied upon a board in the morning, again about noon and for a third time about 4 p.m. In addition pinhead oatmeal is supplied at 10 a.m. and 2 p.m. Skim milk is used for mixing the wet mash, and once a day a teaspoonful of Epsom salts is dissolved in this for each twenty-five birds.

On the third day, the feeding is practically the same, but when the wet mash is fed sufficient chopped dandelions, nettles or onions are mixed with it to double its bulk. From this time onwards soured skim milk, as well as fresh water, is kept constantly before the youngsters.

At ten days old the feeding times are reduced to three a day. The first feed is wet mash, pinhead oatmeal at noon, and wet mash again in the late afternoon The green food is still added to the mash at each meal. At this time the daily dose of Epsom salts is reduced to twice a week. When the chickens are three weeks old the pinhead oatmeal is mixed with an equal quantity of a good dry chick feed. The grain feed is now given in the morning and as a last feed, and at noon fresh, crisp, succulent green stuff is supplied. Wet mash is only given once a week at midday; this so that a weekly dose of salts, which must be increased as the birds grow, can be given in a suitable medium. This is continued until the birds are removed to the woodland run, the quantity supplied being increased as the needs of the birds call for a larger amount.

On removal to the woodland run the birds are given a feed of three parts oats and one part wheat in the morning and again in the afternoon; at midday they are supplied with as much green food as they will eat, together with all the soured skim milk they require. The weekly dose of Epsom salts is continued, this being given in soaked pinhead oatmeal as the afternoon meal.

Six weeks before the birds are due to be killed they are brought up from the woodland run and placed in the breeding pen. The food is the same, except that a little whole maize is added. Three weeks before killing the soured skim milk is used for mixing up the fattening wet mash which consists of equal parts of Sussex ground oats, middlings and bran, and not given separately as heretofore. The wet mash is fed at morning and noon and grain in the afternoon.

The Two Important Foods.—As will be seen by the foregoing the two most important items in the diet are soured skim milk and green food. It is impossible to lay too much stress upon the need for both of these daily right from the time the chicks are three days old until three weeks before they are killed.

During the year 1921 89 turkey chicks were hatched and 84 marketed; in 1922, 103 were brought out, of which 99 were successfully reared and marketed: this year, 117 were hatched and at the present time there are 114 strong, lively birds running in the woodland enclosure. And these numbers have been raised upon a total of 3½ acres of land, the greater part of which is useless for any agricultural purpose.

Raising turkeys on small areas has been proved successful; and one may confidently expect that many others who have the necessary small area of land will take up this branch of the poultry industry.

* * * * * *

THE IMPERIAL FRUIT SHOW, 1923.

II.

J. TURNBULL and A. WHITING,
Ministry of Agriculture and Fisheries.

Apples.—*United Kingdom Section* (cont.).—*Bramley Seedling.*—The first prize in the half-barrel class went to Kent for a fine exhibit of coloured fruit which gained full marks for pack. One barrel was not quite up to the others, and the size was not quite uniform. The second prize lot from Wisbech were well packed, green Bramleys, typical of this variety at its best. The price realised. 33s., exceeded that of all other exhibits of cooking apples in the Show, except Kentish Blenheim Orange, which it equalled. The third lot came from Malvern and were also fine specimens, well packed but rather irregular in size. These three exhibits stood out above all other Bramleys in the Show. Some from Norwich approached them in quality of fruit, but the pack was slack and very low—probably due to woodwool at the bottom of the barrel.

In the bushel class the first prize was awarded to very highly coloured Bramleys hardly typical of the variety and packed much too high above the rim. Towards the close of the Show it was noted that this exhibit was rapidly going off condition The second prize went to West Midland Bramleys in very good condition, but very uneven in size and low in the pack. The third lot were from East Suffolk, Bramleys of typical colour and shape, in fine condition, but pack rather uneven. Mention should also be made of the Kentish exhibit which was first in its own section and realised the same price as the winner of this class. They were very well packed, in very good condition, but rather small.

Newton Wonder.—The winner of this half-barrel class came from Kent. The fruit was on the small side, but of fine colour and the pack was almost perfect. This particular exhibitor showed very good packs in every package, but in half barrels no other exhibitor approached the perfection of his pack. To this was due not only the very large number of prizes won, but also the very high prices realised at the auction sale by his exhibits. The second prize in this class went to Malvern for fine highly coloured fruit, a little uneven in size and pack. This exhibitor's Newtons were almost perfect specimens in every respect except for the prevalence of bitter pit. The third prize exhibit from Wisbech consisted of very fine, large Newtons. The pack was very uniform in colour and size, but a bit low and slack.

In the bushel class the first prize went to Evesham for a very well packed exhibit of highly-coloured Newtons. They were rather off condition and showed bitter pit. The second from Kent were also well packed though lacking in crown, highly-coloured and rather on the small side. These made a considerably higher price.

Lane's Prince Albert.—The first prize in the half-barrel class went to Kent for very highly-coloured Lanes, which, however, were not typical of the variety. They were beautifully packed, but not uniform in size. The second from Herefordshire were also very highly coloured, but not typical of the variety in colour or shape, and too forward in condition. The second prize West Midland Lanes adjoining this exhibit appeared to be in better condition and of more typical colour and finish. The pack was full but slack and not uniform in size. The Norfolk Lanes which were placed third, were typical Lanes in good condition, but the grading was very uneven both in size and colour. If the prices realised at auction are compared with the awards, it is apparent that in all these classes for cooking apples, the judges attached considerably more importance to exceptional colour than the buyers did. Exceptional colour is usually—though not always—gained under circumstances which also cause poor condition of the fruit, and this is a point which should be borne in mind in future.

Any other Variety—In half barrels the first prize went to very fine, large, well coloured Blenheim Orange in good condition, from Evesham These were typical of the best of this variety as sent by this exhibitor. The second prize from Kent was exceptionally well packed and realised a much higher price. The third prize also went to Kent.

In bushels the first prize went to well packed typical green Lord Derby from Wisbech, but like other exhibits of this variety it was too forward in condition and showed a little bitter pit. Second and third prizes went to Kent

Small Holders Classes—There were but few entries in these classes, the numbers in the three classes being as follows :—

		Kent	*East.*	*West.*
Class 15.	Half sieves dessert apples	1	3	2
„ 16.	„ barrels cooking „	—	1	—
„ 17.	Bushels „ „	1	3	1

Class 15 was won with Cox's Orange by the same Berkshire grower than won in classes 1 and 6 He was also second in class 17. Second in class 15 went to Wisbech and the third prize was divided between two growers in Essex. Class 16 went to a Cambridgeshire grower of some fine Lanes and he gained a second in class 17 with the same variety. In class 17 the first prize was not awarded and the third went to Droitwich.

Other Sections.—In the Overseas Section the, Associated Growers of British Columbia won ten classes and tied for first place in another out of 16 classes. This is a most remarkable achievement.

Pears and Other Fruit.—In the United Kingdom Section pear classes, all three prizes went to Kentish growers, the winner showing a superb exhibit. In Conférénce pears the third prize only was awarded to a Warwickshire grower, and in any other dessert variety, second and third prizes went to Evesham and East Suffolk. In any variety of cooking pear the second and third prizes went to Kent and East Suffolk. In tomatoes the second prize only went to a Waltham Cross exhibit. In grapes the third prize only was awarded and that went to Worthing.

In the Channel Islands section, one entry gained first prize for dessert pears and there were no entries of grapes. Two prizes only were awarded in the tomato classes for indoor and outdoor grown fruit.

In the Ulster Section the packing showed remarkable improvement on last year. First and second prizes went to the same two growers in each class.

Auction Prices.—Interesting lessons may be learned from a comparison of the prices realised at auction with the score card points, with the awards and with the different packages used. It should be borne in mind that prices realised are no more infallible than the judges' decision. The prices do not compare in any way with the score card marks as was the case last year. In several cases of great discrepancy between prices and score card marks. we have a good recollection of the quality of the exhibits and we have no hesitation whatever in supporting the judges' opinion. The view has been widely held that the prices are a kind of acid test of the value of the judges' decisions. After making these comparisons, however, we are confident that the judge is more often right than the buyer—as should be the case.

If the prices are compared with the prizes in the Kent, East, and West Sections, the results are satisfactory. If, however, the prices are compared with the awards in the United Kingdom Section, curious discrepancies are to be found. A difference of 2s. would hardly arouse comment, but there are several cases where exhibits have been placed ahead of others which realised from 5s. 6d. to 10s. and in one case 13s. more. Had the judges been different, an obvious explanation would arise: but they were not. The same judges judged the same variety in the three sections and in the United Kingdom section as well. In the three sections their verdict is borne out by the prices, but in the United Kingdom section it is not. Many of these differences are undoubtedly due to bad judgment on the part of the buyer. but there are a few in which we would support the buyer's view. In the majority of these cases the exhibits had one or both of two characteristics—they were either of exceptionally high colour or in poor condition or both. Conversely the exhibits which the buyers valued higher than the judges, were in first rate condition, but not specially noted for colour. It is certain that if there are any defects in the score card, they would be revealed in the United Kingdom section where competition is necessarily keener than in the three home sections. It would appear that the score card should be altered by reducing the number of points given for colour and increasing those given for condition.

Another point worthy of consideration, is whether it would not be better for judging if all apples of one variety were staged together, with sub-headings for the three home sections.

In order to obtain a fair comparison of packages, it seems better to omit prize winners—the price of which is weighted by the prize tickets—and compare unplaced exhibits only. Cox's Orange are a law unto themselves, but a fair comparison cannot be obtained as there were so few entries that nearly all had prize tickets of some kind attached.

Half sieves of " any other variety " made 4s. to 6s. which, after deducting 1s. 6d. for package. leaves 2s. 6d. to 4s. 6d., equal to 5s. to 9s. a bushel. Boxes made 9s. to 14s. equal to 8s. 3d. to 13s. 3d. per bushel. This favours the box, but all these prices were below recent market prices and can hardly be considered a fair test.

A comparison of cooking apples is better owing to the larger classes.

		Average price for unplaced exhibits.			Per bushel after allowing for package.		
		Barrel.	Bushel.	Box	Barrel	Bushel.	Box
Bramleys ...	Kent	15/6	10/9	18/6	9/4	8/3	12/9
,,	East	17/10	15/10	15/-	10/11	13/4	14/3
,,	West	17/6	10/3	13/6	10/8	7/9	12/9
Newtons	Kent	17/-	11/6	—	10/4	9/-	—
,, ...	East	18/-	12/6	18/-	11/-	10/-	17/3
,, ...	West	17/-	12/-	12/-	10/4	9/6	11/3
Lanes ...	Kent	16/3	-	13/-	9/10	—	12/3
,,	East	17/3	—	12/-	10/6	—	11/3
,, ...	West	17/-	—	—	10/4	—	—

The averages of these per bushel net are :—

In boxes	13/1	per bush.
,, barrels	10/4	,,
,, bushels	9/8	,,

showing a small advantage for barrels over bushels and a considerable advantage for boxes over both.

The average prices of exhibits in classes 1-14 in the three sections are also of interest :—

Section.	1st	2nd	3rd	Unplaced
East	23/6	18/2 ...	14/4 ...	13/8
Kent	23/8	16/- ...	13/3 ...	12/6
West	21/8	15/6 ..	13/6 ...	11/2

Sale Catalogue.—In view of the poor prices realised for fruit of such high and uniform quality, it would appear that some re-arrangement of the sale catalogue might bring about an improvement. It would certainly facilitate matters if the sale of one variety was completed before passing on to another—*e g*, Lots 1-50 Cox's Orange Pippin, Lots 51-71 Worcester Pearmain and so on. This, together with all apples of one variety staged together, as mentioned above, would enable buyers to see at a glance exhibits suitable for their requirements. All varieties in "any other variety" classes should, in future, be named in the auction catalogues. This is borne out by the low prices realised for Cox's in Class 1 of the British Empire Section. This variety together with Allington Pippin other than prize lots, averaged no more than 10s 8d. per box. Similar examples are to be found in the sale of the culinary class in the same section.

The British Empire section should be sold first and not last as under the present system, which necessitates a buyer waiting to the end of the sale to purchase the best apples in the show.

Packages.—The general improvement in box packing and the increasing popularity of the non-returnable package, have done much to favour the elimination of bushels and half sieves at future shows. In the first place. the cost of the new wicker is more or less a dead loss to the exhibitor and secondly, elaborate methods of covering and lining the baskets to prevent bruising, are adopted by many growers—a practice which does not comply with the rule that " All exhibits shall be packed under commercial conditions." Also, there is unfortunately a considerable amount of pilfering due to easier access to the fruit.

The proved suitability of the box for high grade culinary varieties, as shown in Class 2 of the British Empire Section, even goes so far as to suggest the confining of the Show to the box package only, until such time as a suitable non-returnable barrel can be made at an economic price.

It may be argued that the smaller grower has not sufficient fruit to select from to enter in the seven-box or barrel classes, but the difficulty can easily be overcome by substituting a four-box class in the case of half sieves and a four-barrel class in place of seven bushels, growers of more than 20 acres being excluded.

" Any Other Variety " Classes.—Surely it is an anachronism to have any other variety classes at a commercial fruit show. Some exhibitors contend that these classes are especially of interest from the point of view of introducing new varieties. The entries at each of the three Imperial Fruit Shows, however, have brought nothing of merit and usually consist of old well-known sorts, which are now little planted. Why include varieties none of which is of sufficient commercial value to have a named class for it? It is suggested that in place of the " any other variety " dessert classes, a class for 3 boxes of any dessert variety—season to follow Worcester Pearmain and precede Cox's Orange Pippin—be made. In this way a suitable variety to fill present requirements might be forthcoming in course of time. The class for King of the Pippins might be reinstated, or it might be included with one of the other varieties.

" Any other variety " culinary classes seem to serve no useful purpose and might be withdrawn from the schedule entirely. A new interesting class might be instituted, however, to comprise one ton (56 boxes) of Bramley, Newton or Lane's Prince Albert, open to the British Isles. Growers of Blenheim Orange, Annie Elizabeth, Lord Derby, Bismarck or King Edward VII might wish to be included, and this point might be considered.

Rules and Disqualifications.—There are so few exhibitors now who fail to comply with all the rules, that in future all rules should be rigidly enforced. Admittedly it is hard luck for the sender of a good exhibit to be disqualified, possibly through a pure oversight, but after all he has only himself to blame, and it is a good deal harder for the other exhibitors who have taken great pains to comply with all rules, to be beaten by a very small margin by such a sender. In order to simplify the awarding of special prizes with peculiar limitations (*e.g.*, growers in certain counties, or members of certain associations, or showing both culinary and dessert), there should be a rule to the effect that " No special prize which is not open to all competitors in a section shall be awarded to any exhibitor who fails to state on his entry form the special prizes for which he is eligible and the reason of his eligibility."

Rule 12 was intended to apply to apples in boxes only. " For apples diagonal on-side packs only may be used." At least one exhibitor thought this applied to all packages, in spite of the fact that it is impossible to use a diagonal pack in a round package. This sentence ought therefore to be re-written. " Diagonal on-side packs only may be used for apples in boxes " would do. This pack is favoured because it is standard for box packing.

It is now recognised that " ringing-in " in round packages is a commercial proposition and if any round packages continue in the show, it might be made compulsory. In connection with this point, it is to be noted that many exhibitors put a thick layer of wood wool in the bottom of the package so as to get the right height. This was the chief cause of slack packs The only way to build a firm pack to the right height, when this does not happen with all the apples turned the same way, is to pack some layers flat and some on-side. The last layer should preferably be on-side as it gives a better appearance. The correct way to retain the " crown " when " ringing " is to pack the centre apples tightly from the bottom up. Choosing larger sizes for the top centre apples is useless if the crown is not built all the way up. Wood wool in boxes, barrels or wickers is a delusion and a snare. Sparingly used it can be made to serve a useful purpose, but over anxiety makes the exhibitor use too much. Inside the package, anything more than a few strands causes a slack pack and on the top of the package the dusty material contained in it is a nuisance to the user's exhibit and all surrounding it The use of wood wool in these packages and of hay or fodder should be prohibited entirely. The cleanest and best material to use is stiff wheat straw, laid straight across the package and with the ends clipped off after tying down. Hay becomes musty with the sweat of the fruit. A card should be sent to each exhibitor stating the packing rules shortly and exactly and for what bad points he will be disqualified. This would avoid much misunderstanding and disappointment.

As a guide to exhibitors on the controversial question of size, we would suggest that a judge's rule should be made to the effect that the following sizes will receive full points for size :—

Cox's Orange Pippin	150–200 per box.	
Any other dessert	150–175	,,
Any culinary variety	80–96	,,

As a further guide a packing card showing the counts to the various packs might be included in the schedule.

In conclusion, we would emphasise the importance of several points :—

(1) Reduction in the number of classes, especially in the case of "Any other Varieties."

(2) The adoption of the box for culinary variety classes.

(3) Tightening up of the Rules.

(4) Standardisation in judging.

(5) Increased opportunities for the public to purchase exhibition fruit.

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NOTES ON MANURES FOR JANUARY.

H. V. GARNER, B.A.,

Rothamsted Experimental Station.

Phosphates and Potash for Grass Land.—The value of phosphates, either alone or with potash, for improving the yield and quality of grass land is well known. The increase in clovers following such treatment is usually marked; and under favourable conditions, as, for example, in a soil containing chalk and well supplied with available potash, the response is very considerable. On such a soil at Horndon, Essex, the following results were obtained by Robertson :—

Treatment.	*Hay.* cwt. per acre.	*Clover.* per cent.	*Grasses.* per cent.	*Weeds.* per cent.
Unmanured	6.4 ...	8.7 ...	81.4 ...	9.9
High soluble slag ...	23.2 ...	45.4 ...	53.3 ...	1.3
Gafsa phosphate ...	22.3 ...	63.8 ...	32.0 ...	4.2

On the continuous hay plots at Rothamsted the average yields for a recent 10-year period, and the botanical analysis for a typical year were :—

Treatment.	*Hay (1st crop).* cwt. per acre.	*Clover.* per cent.	*Grasses.* per cent.	*Weeds.* per cent.
Unmanured	10	5.8	54.3	35.6
Superphosphate only	13	7.5	55.9	33.6
Superphosphate + sulphates of soda and magnesia	17	10.6	62.7	25.8
Superphosphate + sulphates of soda and magnesia + sulphate of potash	26	16.9	68.0	14.6

In this case it is seen that to maintain the yield and quality of permanent meadow land, potash is necessary as well as phosphate, and that salts of soda and magnesia, while not so effective as potash for this purpose, have still a definite value.

When land treated with phosphates and potash is grazed, similar results are observed in the herbage. The larger growth and improved quality enable more stock to be carried, and the production of the pasture for milk and meat is increased. The results of a few experiments may be quoted :—

PRODUCTION OF MILK.

Centre.	*Treatment per Acre.*	*No. of Seasons of Experiment.*	*Increase per Acre per Season over no Manure Land.* *Actual gal.*	*Per cent.*
Klonakilty Agricultural School	10 cwt. slag	3	63	21
Klonakilty Agricultural School	7½ cwt. slag	2	102	66
Midland Agricultural College	4 cwt. superphosphate 1½ cwt. sulphate of potash	4	93	58
Harper Adams Agricultural College	2½ cwt. superphosphate annually	3	33	19
	2½ cwt. superphosphate 1½ cwt. sulphate of potash annually	3	56	32

PRODUCTION OF MEAT.

			Actual Increase Live weight lb.	
Cockle Park, sheep grazing	10 cwt. slag applied on 3 occasions	21	87	300
Saxmundham, sheep grazing	10 cwt. slag applied on 2 occasions	11	62	83

The experiments quoted above were costed and in every case the expenditure on manures was amply covered by the value of the extra produce. The slags used were of the high-grade,

high-soluble type, *i.e.*, containing from 30-40 per cent. of phosphate, 80 per cent. or more soluble in citric acid. Under present conditions slags are often obtained containing only about 20 per cent. of phosphate. Some of these low-grade slags are as soluble as the old high-soluble slags, but others are distinctly less soluble in citric acid. It is often asked whether the same results can be expected from low-grade as from high-grade slags. A large amount of experimental evidence is accumulating on this point and the general indications are that the low-grade slags of high solubility are much the same in their action as the high-grade slags if applied at the same rate of phosphate per acre (*e.g.*, 10 cwt. of a 20 per cent. slag provides the same amount of phosphate as 5 cwt. of a 40 per cent. slag). The low-grade slags of low solubility have not usually come into action as quickly as the high-soluble types, and do best on peaty soils and in wet districts.

Potash can be applied to grass land more economically as muriate of potash or as the crude potash salts (kainit, sylvinite, etc.) than as sulphate of potash. The salts of soda, and in some cases of magnesia, which are introduced with the potash in the crude salts, are valuable on grass land; and the potash itself is purchased at a lower unit price than in sulphate of potash. A rough scale of equivalent quantities of potash is:—

1 cwt. sulphate of potash = 1 cwt. muriate of potash.
" " " = 1⅔ cwt. 30-per cent. potash salts.
" " " = 2½ cwt. 20-per cent. French extra kainit.
" " " = 4 cwt. 12½-per cent. kainit.

Prices of Potash Manures.—There have recently been considerable differences in the unit value of potash in the various potash manures now available. These values are obtained by dividing the price of the manure per ton by the percentage of potash contained, and represent the price of one-hundredth part of a ton (22.4 lb.) of pure potash (reckoned as K_2O) when bought in the form in question. Thus muriate of potash containing 50 per cent. of pure potash has recently been quoted at £7 15s. 0d. per ton f.o.r. in London in 2-ton lots for cash. The unit value of potash in this form is therefore $\frac{155}{50}$/=3/1.

When figures obtained in this way are used to compare potash manures in the same class, *i.e.*, containing similar amounts of potash in the same chemical form, they give a useful basis of valuation. The following were average prices in London for the week ending 5th December:—

Manure.	*Potash.* Per cent.	*Price.* Per ton. £ s.	*Cost per Unit in London.* s. d.
Kainit	12½ ..	2 5 ...	3 7
Kainit	14 ..	2 10 ...	3 7
Sylvinite	20 ...	2 15 ...	2 9
Potash salts	30 ...	3 15 ...	2 6
Potash salts	20 ...	2 12 ...	2 7
Muriate of potash ...	50 ...	7 15 ...	3 1
Sulphate of potash ..	48	10 15 ...	4 6

Certain forms of potash, however, are not interchangeable under all conditions, and in many cases the respective properties of the alternatives should be taken into account as well as their unit prices. For example, 20-per cent. sylvinite is not as safe a manure for potatoes as sulphate of potash, and although it can be purchased at a cheaper unit price this would not be the deciding factor in buying. Some potash manures such as kainit and 20-per cent. sylvinite provide more common salt than those of higher grade and the salt is of value to mangolds and grass. Some, such as ordinary kainit, contain in addition to common salt some sulphate of magnesia which appears to have value under certain conditions.

The following are closely comparable within their sections on all crops and the unit values form a good guide on which to purchase:—

(1) 12½-per cent. kainit and 14 per cent. kainit;

(2) 20-per cent. sylvinite, 20-per cent potash salts, and 30-per cent. potash salts.

The following are closely comparable for all crops except potatoes and market garden crops:—

(1) 50 per cent. muriate of potash and 48-per cent. sulphate of potash.

The following are roughly comparable within their sections on all crops, the unit values not being the only consideration, but should be regarded in the light of differences in composition between alternatives and of their different effects on special crops:—

(1) 12½-per cent. kainit, 14-per cent. kainit, 20-per cent. sylvinite, 20-per cent. potash salts, and 30-per cent. potash salts.

(2) 48-per cent. sulphate of potash, and 50-per cent. muriate of potash.

Of the lower grade manures it will be noticed that 30-per cent. potash salts are offered at an attractive unit price; and muriate of potash is also cheap and deserves attention in cases where it has been decided not to use sulphate of potash for potatoes, or where a concentrated potash manure is wanted for a mixture for cereals.

The most useful unit values from the farmer's point of view are calculated on the cost of the manures when delivered on the farm. These are obtained by adding to the f.o.r. quotations the approximate charges for carriage and cartage (or to quotations at the farmer's station, the cost of cartage): the price per ton on the farm is then divided by the percentage of the constituent in question.

Basic Slag or Lime?—Farmers often ask whether it is necessary to use lime on their land if the phosphates are supplied as basic slag. Slags contain a small amount of chalk and free lime, and also a larger amount of calcium silicate which has the same effect as chalk in the soil. The quantities of these substances vary in different slags, but the following rough figures calculated as chalk give an idea of what is usually found:—

Present in Basic Slag.	*Equivalent Calculated as Chalk.*
Chalk Quick lime	5 per cent.
Calcium silicate	45 „ „
Total	50 „ „

It will be seen that when slag is used an amount of basic material is left in the soil, which, reckoned as chalk, is equal in weight to about half the slag applied. By far the greater part of this is provided by the calcium silicate contained in the slag. Much arable land which is slightly sour, and carries poor crops in consequence, has a lime requirement of about 30 cwt. of chalk per acre. To sweeten such land by the application of basic slag is quite impracticable. If, for example, in a four-course rotation 6 cwt. of slag is applied to roots and a further 6 cwt. to clover, slag is being given at the rate of 3 cwt., and chalk equivalent at the rate of about 1½ cwt. per acre per annum. Dressings at this rate are not only insufficient to counteract even a slight degree of acidity, but will not supply enough chalk to replace the annual wastage through drainage and the interaction with artificial manures, which is estimated to be at least 5 cwt. of chalk per acre. One of the few advantages of using low-grade basic slags is that, in applying heavy dressings in order to provide the necessary phosphate, correspondingly large amounts of chalk are being restored to the soil.

Liquid Manure.—On farms where there are facilities for collecting liquid manure an application may be given to grass land at this time of the year. The liquid, consisting of the drainage from cow houses, stables, and manure yards diluted with rain water, is of very variable composition but has considerable manurial value, and its constituents are present in a readily available form.

As an average of 85 samples collected from Scotch farms Hendrick found that 1,000 gallons (4½ tons) of the liquid contained:—

	lb.	*Equivalent to lb.*	*Approximate value.*
Nitrogen (chiefly as ammonium salts)	20	100 Sulphate of ammonia	12s.
Phosphoric acid	3	—	—
Potash	46	3 cwt. Kainit	7s.

Liquid manure is therefore relatively rich in potash and in nitrogen, but poor in phosphate, and against its manurial value of about 19s. per 1,000 gallons must be reckoned the labour involved in applying 4½ tons of liquid to the land. There is little risk of loss in applying liquid manure to grass land in winter. The potash is held in the soil till the plant can use it: while the nitrogen, being largely in the form of ammonium salts, is also held until it is converted into nitrate; when the soil is warm enough for this to occur the grass is also capable of growth and takes up most of the nitrate as it is formed. Liquid manure has given good results on meadow land, whether applied in December or early spring. It is usual to cart out the liquid at intervals during winter and spring as the tanks are filled, giving two or three dressings each of about 1,000 gallons per acre Results obtained in Ireland, as an average of 54 experiments on the hay crop, show that two applications of liquid manure each of about 2,000 gallons, are as effective in the first crop as a heavy dressing of dung or a light and complete dressing of artificials.

Manures per acre.	*Hay (cwt. per acre).*
No manure	44
16 tons liquid manure (half in February, half in April) ...	60
16 tons dung	61
1 cwt. nitrate of soda ... ... 2 cwt. superphosphate ... ... 2 cwt. kainit	61

Liquid manure is also a valuable dressing for catch crops such as rye. oats and tares, etc., which are required to make quick growth in spring, for since they are usually taken on light early land these crops respond well to a mixed nitrogenous and potash dressing of a quick acting kind.

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending December 5th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.15	13.15	13.10	13. 2	16.11
„ „ Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.13*	13.13*	13.13*	13.13*	(N)18. 2·
„ „ „ neutral (A. 25¾ per cent.)	14.16*	14.16*	14.16*	14 16*	(N)14. 0
Kainit (Pot. 12½ per cent.)	...	..	...	2. 5	3. 7
„ (Pot. 14 per cent.)	2. 7	2. 6	2.10	2.10	3. 7
Sylvinite (Pot. 20 per cent.)	...	...	...	2.15	2. 9
Potash Salts (Pot. 30 per cent.)	...	..	...	3.15	2. 6
„ „ (Pot. 20 per cent.)	...	...	..	2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 2	8 10	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	13.10	...	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.)	...	...	...	3.10§	2. 0
„ „ (T.P. 30 per cent.) ...	...	...	...	2.17§	1.11
„ „ (T.P. 26 per cent.)	2.13§	2. 0§	...	...	...
„ „ (T.P. 24 per cent.)	2. 9§	1.18§	2. 0§	...	...
„ „ (T.P. 20-22 per cent.)	...	1.13§	.	2. 5§	2. 3
„ „ (T.P. 18 per cent.)	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.13	...	3. 7§	3. 5	1.10
„ (S.P. 30 per cent.) ...	3. 6	3 2	3. 0§	3. 0	2. 0
Bone Meal (A. 4½. T.P. 45 per cent.) ...	9.10	8. 5	9. 0	8. 2	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6. 5	6. 5†	6.10	6. 5	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	..	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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MONTHLY NOTES ON FEEDING STUFFS.

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Brewery and Distillery By-Products.—In the manufacture of beer, by-products arise which have a distinct feeding value for farm animals, and find a ready sale in most markets.

In beer brewing the barley is soaked in water, germinated and killed. The sprouts that are removed in the process are known as *malt culms*, the residual grain forming the malt of commerce. The malt is then digested in water, the liquid that results being separated from the grain residues, which are dried and form the dried brewers' grains. The liquid is then boiled with hops, cooled, and the hops separated. These *spent hops*, after drying, form the basis of several compound feeding stuffs now on the market. Spent hops, apart from a possible medicinal value, are of no value to the stock feeder. The filtered liquid is now fermented with yeast, cleared and is ready for casking or bottling. The yeast that arises finds its way on the market as brewers' yeast, and is a very valuable feeding stuff.

Malt Culms.—Malt culms contain 20 per cent. digestible crude protein, 12 per cent. of which is true protein, and has a starch value of 43.4. Its nutritive ratio is **1 : 3**. A good sample should be dry, light yellow in colour and pleasant smelling. It is a good food for all classes of stock, and is easily digested. Malt culms are generally fed dry to horses, but are best soaked or scalded for other stock. They may be fed up to 6 lb. daily to horses, 3 lb. daily for cows and fattening cattle, up to ¾ lb. to sheep, and up to 1½ lb. to pigs. Owing to the tendency of malt culms to become damp and go mouldy, care must be exercised to store them in a dry place.

Brewers' Grains.—Brewers' grains are of value for all classes of stock and can be fed wet or dry. In a wet condition the difficulty of cartage restricts their use to those farms situated near the brewery, except where special provision exists for keeping the grains. By means of cemented pits, and by the use of a little salt, brewers' grains may be kept in excellent condition for months, and pits of this description are in common use in the west country and in some parts of Kent. Dairy cows may be fed up to 30 lb. daily of the wet grains and pigs

DESCRIPTION.	Price per Qr.		Price per			Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
			Cwt.	Ton.								
	s.	lb.	s.	£	s.	£	s.	£	s.		s.	d.
Wheat, British - -	—	—	10/3	10	5	0	16	9	9	71·6	2/8	1·43
Barley, British Feeding	—	—	9/3	9	5	0	12	8	13	71	2/8	1·29
„ Canadian No. 4 Western	32/-	400	9/-	9	0	0	12	8	8	71	2/4	1·25
„ Persian - -	30/6	400	8/6	8	10	0	12	7	18	71	2/3	1·20
Oats, English, White -	—	—	10/6	10	10	0	14	9	16	59·5	3/4	1·78
„ „ Black and Grey - - -	—	—	9/-	9	0	0	14	8	6	59·5	2/9	1·47
„ Scotch, White -	—	—	10/6	10	10	0	14	9	16	59·5	3/4	1·78
„ Canadian No. 2 Western	29/9	320	10/5	10	8	0	14	9	14	59·5	3/3	1·74
„ „ No. 3 „	27/3	„	9/6	9	10	0	14	8	16	59·5	2/11	1·56
„ American -	24/0	„	8/5	8	8	0	14	7	14	59·5	2/7	1·38
Maize, Argentine - -	42/-	480	9/10	9	17	0	13	9	4	81	2/3	1·20
„ South African -	40/6	„	9/5	9	8	0	13	8	15	81	2/2	1·16
Beans, Rangoon - -	—	—	8/-	8	0	1	12†	6	8	67	1/11	1·03
Peas, English, Maple -	—	—	14/6	14	10	1	8	13	2	69	3/10	2·05
„ Japanese - -	—	—	25/0	25	0	1	8	23	12	69	6/10	3·66
Millers' Offals :—												
Bran, British - -	—	—	—	7	5	1	7	5	18	45	2/7	1·38
„ Broad - -	—	—	—	8	5	1	7	6	18	45	3/1	1·65
Middlings, Coarse, British - -	—	—	—	8	10	1	2	7	8	64	2/4	1·25
Meal, Barley - -	—	—	—	10	5	0	12	9	13	71	2/9	1·47
„ Maize - - -	—	—	—	11	0	0	13	10	7	81	2/7	1·38
„ „ S. African -	—	—	—	9	2	0	13†	8	9	81	2/1	1·12
„ „ Germ -	—	—	—	10	10	0	19	9	11	85·3	2/3	1·20
„ „ Gluten-feed	—	—	—	8	15	1	7	7	8	75·6	1/11	1·03
„ Locust Bean -	—	--	—	8	10	0	9	8	1	71·4	2/3	1·20
„ Bean - - -	—		—	12	10	1	12	10	18	67	3/3	1·74
„ Fish - - -	—	—	—	20	0	4	6	15	14	53	5/11	3·17
Linseed - - - -	—	—	—	23	5	1	11	21	14	119	3/8	1·96
„ Cake, English 9°/ₒ Oil	—	—	—	14	0	1	18	12	2	74	3/3	1·74
Soya Bean Cake 6°/ₒ Oil	—	—	—	12	0	2	14	9	6	69	2/8	1·43
Cottonseed Cake, English 5½°/ₒ Oil	—	—	—	8	2	1	15	6	7	42	3/-	1·61
„ „ Egyptian 5½°/ₒ Oil	—	—	—	7	17	1	15	6	2	42	2/11	1·56
Decorticated Cotton Seed Meal 7°/ₒ Oil -	—	—	—	13	10	2	14†	10	16	71	3/1	1·65
Coconut Cake 6°/ₒ Oil -	—	—	—	9	10	1	11	7	19	73	2/2	1·16
Palm Kernel Cake 6°/ₒ Oil - - - - -	—	—	—	6	12	1	3†	5	9	75	1/5	0·76
Palm Kernal Meal 2°/ₒ Oil - - - - -	—	—	—	5	12	1	4	4	8	71·3	1 3	0·67
Feeding Treacle - -	—	—	—	6	15	0	8	6	7	51	2/6	1·34
Brewers' Grains :—												
Dried Ale - -	—	—	—	8	2	1	4	6	18	49	2/10	1·52
„ Porter - -	—	—	—	7	12	1	4	6	8	49	2/7	1·38
Wet Ale - - -	—	-	—	1	16	0	9	1	7	15	1/10	0·98
„ Porter - -	—	—	—	1	13	0	9	1	4	15	1/7	0·85
Malt Culms - - -	—	—	—	7	10	1	14†	5	16	49	2/8	1·48

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 11s. per ton. The food value per ton is therefore £8 9s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices :—N, 13s. 2d.; P_2O_5, 4s.; K_2O, 2s. 6d.

may be given up to 2½ lb. per 100 lb. live weight. It is not customary to feed wet grains to other classes of stock than pigs and cows.

Dry brewers' grains, which contain 13 per cent. digestible protein, have a nutritive ratio of 1 : 4 and a starch equivalent of 48.3. With horses, half the oat ration may be replaced by dried grains with advantage, sheep may be given up to 1 lb. daily, and cows and fattening cattle may be given up to 6 lb. daily. Dried grains contain too much fibre to render their use with pigs profitable.

Dried Yeast.—Brewers' yeast in a dried form is a valuable feeding stuff. The wet yeast is dried on rollers, and comes off in the form of reddish brown light flakes. Dried yeast is a protein-rich feeding stuff, and contains 42 per cent. digestible protein, has a nutritive ratio of 1 : 1, and a starch equivalent of 67.2. It is of particular value for young growing stock. Owing to its richness in protein it should never constitute more than 10 per cent. of the total meals or cakes fed in the ration. It is inadvisable to mix it with sugary foods, unless a guarantee has been given that the process of manufacture has resulted in the death of the enzyme which causes fermentation to set up when yeast is added to sugary materials.

FARM VALUES.

CROPS.	Market Value per lb. S.E. d.	Value per unit S.E. s. d.	Starch Equivalent per 100 lb.	Food Value per Ton. £ s.	Manurial Value per Ton. £ s.	Value per Ton on Farm. £ s.
Wheat - - - - -	1·16	2 2	71·6	7 15	0 16	8 11
Oats - - - - - -	1·16	2 2	59·5	6 9	0 14	7 3
Barley - - - - -	1·16	2 2	71·0	7 14	0 12	8 6
Potatoes - - - - -	1·16	2 2	18·0	1 19	0 4	2 3
Swedes - - - - -	1·16	2 2	7·0	0 15	0 2	0 17
Mangolds - - - - -	1·16	2 2	6·0	0 13	0 3	0 16
Good Meadow Hay - -	1·52	2 10	31·0	4 8	0 14	5 2
Good Oat Straw - - -	1·52	2 10	17·0	2 8	0 7	2 15
Good Clover Hay - -	1·52	2 10	32·0	4 11	1 0	5 11
Vetch and Oat Silage - -	1·34	2 6	14·0	1 15	0 7	2 2

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JANUARY ON THE FARM.

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Weather.—January is usually the coldest month of the year. It has been in this month that the severest frosts have occurred, the Thames having been firmly frozen over on a number of occasions recorded in English history. Likewise the most memorable snowstorms have been experienced in the first few weeks of the year. The temperature of the air and of the top soil is for the greater part of the time below that at which appreciable plant growth can take place, and the duration of bright sunshine is at its minimum—about one-fifth of the figure for May. January is the middle period of what farmers call the dead season, when grass, corn and all other outdoor vegetation are practically at a standstill.

In recent winters the wetness of January weather has been more in evidence than its normal low temperature. In most districts the January rainfall is high compared with that of the next two months, and owing to this, coupled with the little evaporation that takes place at this season, the land usually lies wet and sodden, the arable unfit for tillage operations and the grass land too soft to permit carting on it. Short spells of cold dry weather or black frost are appreciated by farmers, but tradition condemns conditions mild enough to allow the grass to resume growth in this month.

Sowing Wheat and Oats.—November and—to the time of writing—December have not favoured sowing operations, and the area intended for winter cereals has not been completed. After the middle of January wheat seeding may be resumed at the first opportunity when the soil is dry enough. The ordinary winter varieties such as Standard Red and Victor may be sown in preference to spring wheats, but unfortunately there is no experimental evidence on which to base a recommendation of any particular variety for drilling at this time of the year.

The depth of sowing is an important factor affecting the success of corn sown during the colder months. Shallow covering ensures an earlier and thicker plant than is obtained with deep drilling, and the risk of throwing out by frost is reduced rather than increased. Birds often trouble late sowings, especially after the seed has sprouted; but taking all things into consideration it is unadvisable to drill deeper than is necessary just to cover the seed—a depth of about one inch should be aimed at.

Occasionally very good crops are obtained from January sowings. For instance, last year a friend of the writer's drilled Squarehead's Master on 17th January, adopting the advice as to shallow covering. In the previous season the land had grown early potatoes followed by a catch crop of marrow-stem kale. The wheat came well, stooled out thickly and was ready for cutting at the ordinary time; it was estimated at about 6 qr. per acre by the judges of a competition for which the farm was entered. Nevertheless it cannot be contended that January is a good sowing month for most parts of England; in many districts the risk of failure would be high and good results could be obtained only when the season happened to be unusually favourable. The lowest temperature at which wheat will germinate is 37° to 39° F., while the mean temperature in January at a selection of places is:—York 37.9°, Nottingham 37.6°, Cambridge, 37.6°, Llandudno 41.4° and Plymouth 42.2° F. The daily temperature fluctuates about 5° above and below the mean, so that normally growth could be only intermittent at most places during this month.

Only good bold seed should be used for sowing at a time when the food reserves in it are likely to be fully needed; and it is desirable to sow about a bushel per acre more than is necessary in October, not only because of the greater mortality but also because the January sowing has missed the tillering which goes on in the milder weather of October and early November.

It is an accepted principle in farm management that the first chance should be taken. This rule is applied to seeding operations in the old saw "Sow when you can and wait when you must." Accordingly many farmers will take any opportunity which dry weather may afford to sow winter oats this month. Winter oats require about one degree higher temperature for germination than wheat, and in districts where wheat may be sown in January winter oats are not commonly sown till February. In this connection it is perhaps noteworthy that greys are hardier than blacks. As to the hardiness of the whites recently introduced, there is as yet little experimental evidence. In 1922 the writer saw a nice piece which had been sown in January. and last season a fairly good crop which had been sown in February.

Ploughing.—Leas intended to be followed by spring oats are very commonly ploughed in January. Where broadcasting is practised, the lea furrow is turned with a long breast and the ordinary dimensions of the slice are 8 in. by 5 in. In order that seed may not fall through the bottom of the seams and be lost, the work must be straight and of uniform depth—crooked or wavy slices do not fit together properly but leave crevices—and the furrows must be packed together. Where the ploughing has been well performed, the corn yields fully as well as drilled crops.

Where the corn following "seeds" is to be drilled, the ploughing may be performed more expeditiously with a digger or semi-digger. In this case also, since there is no need to preserve an "arras" or crest to provide covering for the seed, the turf can be better buried; and, where ploughing can be done earlier, the work need not be delayed till after Christmas for fear of the grass growing through the seams.

Corn stubbles still unploughed at this date are in most cases those of the last crop in the rotation and therefore coming green-crop or bare-fallow in 1924 : the rules of good husbandry allow of the presence of a reasonable quantity of weeds at this stage in the cropping, as the land will be cleaned before another crop is sown. Stubbles intended to be bare-fallowed in 1924 are better left unploughed for another month or two, as in this case it is undesirable to obtain a frost mould. The stubbles intended for roots should, of course, be turned over as soon as practicable.

In dealing with a twitchy piece of land, particularly where the weedy growth is confined to the top few inches, there are, at this time of the year, two alternatives:—(1) To plough shallow, leaving the weeds near the surface with a view to their easier eradication in spring before a second and deeper ploughing; (2) To plough deeply, using a digger and large skim coulter, burying the weedy layer in the hope of killing and rotting it. The choice will be determined by conditions. On fairly heavy land the second method is preferable, partly because on heavy soils a second ploughing late in spring should be avoided, and partly because this class of work really does kill twitch on heavy land, provided that the ploughing is efficient in the matter of placing the weeds out of reach of light and air. On lighter land the second method would not be good, because the weeds would grow through the deepened layer and then be more difficult to extract. Also in this case a second ploughing does not hopelessly destroy the tilth : where moisture conditions will not allow of a second ploughing in spring, the necessary depth of tilth can on light land be obtained by successive operations with the cultivator or spring tooth harrow.

Boxing Seed of Late Potatoes.—Second early and late varieties if not already bought should be ordered now, and the former should certainly be boxed by the end of the month. As regards late potatoes, boxing is not the rule, although it would seem that there is a good case for the extension of the practice. Timely boxing usually increases the yield of ware by about 1½ tons per acre; and, as "rogues" and "duds" are shown up by their sprouts or by the absence thereof, the crop planted with sprouted seed can be purer and more regular than it might otherwise be. Where planting was necessarily late, the advantage of proper and timely boxing might be 2½ tons per acre. On the other hand, with early planting, seed taken direct from the pit may yield almost as well as boxed seed. The virtue of boxing is not confined to the preservation of the first sprout; apparently the wilting of the setts in the boxes is advantageous.

* * * * * *

Clean Milk Production.

ONE of the chief characteristics of the London Dairy Show last October was the great display of special utensils and machinery designed to help in the production of Certified and other designated milk. The view held by many authorities that such milk is to be the milk of the future received support from the fact that in the Main Hall of the Show in a very prominent position there was a Stand under the joint auspices of the Ministry of Agriculture, the British Dairy Farmers' Association and the National Institute for Research in Dairying, Reading. At this Stand three demonstrations were given daily with the object of showing not only to producers, but also to the general public, how Certified Milk is produced.

In England alone there are at present nearly 150 producers of Certified, Grade-A (Tuberculin-tested) and Grade-A milk. This number is gradually increasing and it is hoped that in course of time there will be available an ample supply of the very cleanest of raw milk. Farmers will produce it if the public demands it. Greater care, and incidentally greater expense, are needed for its production than for ordinary milk, and hence its cost to the consumer is somewhat higher, but since such milk will keep sweet, even in the hottest of weather, for a long period, it is in the end the cheapest milk to buy.

The Stand was divided into three sections. One section was allotted to two cows, the next represented the room where the washing and sterilising of utensils takes place, and the third where the milk is cooled and bottled. At each demonstration the essentials of clean milk production were carefully explained.

Special buildings and stall fittings are sometimes an advantage, but cleanliness in all things must be the watchword; without cleanliness Certified Milk cannot be produced. The cow must be both clean and healthy, and the cowshed clean, well ventilated and well lighted, for sunlight kills germs. The flanks and udder of each cow should first be washed and then wiped with a clean cloth. The milkers must be scrupulously clean; they must wash their hands before milking and milk with dry hands. A great advantage is the use of a Davis or similar small-mouthed milking pail, into which dust is less liable to fall than into the ordinary pail. Immediately after milking the milk should be removed from the cowshed to the dairy, and there strained and cooled to as low a temperature as possible. It should then be run into bottles, which have previously been sterilised; these should then be capped and sealed and kept in a cool room. All utensils must be carefully washed and then sterilised. They should be sterilised again immediately before use.

While all this was being carefully explained by the Demonstrator, the cows were milked, and the milk strained, cooled, and bottled, as would be done on a certified milk farm. Both the milker and dairymaid wore white overalls.

The growing popularity of this kind of milk was evidenced by the crowds that assembled in front of the Stand, some time before each demonstration was timed to take place. In the intervals, too, the demonstrator and his assistants, as well as the Ministry's representative, were assailed with questions dealing with the problems of producing Certified Milk.

This is a phase of dairy farming that has come to stay, and it is to be hoped that it will lead to a greater consumption of milk, especially by children. This, in turn, will improve the national health for, taking bulk for bulk, no other drink in the world contains so much nourishment as is to be found in milk.

* * * * * *

Short Course in Clean Milk Production.

A COURSE of instruction in the production and handling of milk will be held at University College, Reading, from Wednesday, 30th January, to Saturday, 23rd February, 1924. The course is intended primarily for dairy instructors and instructresses, but other students will be admitted if the limited accommodation (24) will allow. Applications for admission to the course should be made in the first instance to the Dean, Faculty of Agriculture and Horticulture, University College, Reading, and intending students should be prepared to commence work at 9.0 a.m. on Wednesday, 30th January.

The fee for tuition for the three weeks will be £5, which must be paid to the College Office.

Lectures will be given on milk production and supply, chemical composition of milk, and diseases of cattle affecting milk supply; and demonstrations of practical bacteriology in connection with the handling of milk will be arranged. Excursions will be arranged to well-known dairy farms, factories and depôts, but the travelling expenses in connection therewith are not included in the tuition fee.

The College cannot undertake to arrange residence for students, but will give all possible assistance and advice thereon. Students are advised to take bicycles with them.

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Insect Pest Control.

CURIOSITY has been expressed as to a recent notice in the Press referring to a consignment of earwigs sent from this country to New Zealand to destroy bacteria. Such a statement would probably fill the residents of New Zealand with misgiving, as the earwig is already a pest there to an extent unknown in this country. The truth is that the recent consignment to New Zealand consisted of the puparia of *parasites* of the earwig, and in some cases the earwigs themselves with the parasites inside them. These earwig parasites do not occur in New Zealand, and it is hoped that they will increase and multiply there at the earwigs' expense and so form a natural control of that pest The earwig itself, being an insect which has been accidentally introduced into New Zealand, possesses no natural enemies sufficient to keep it in check and maintain a balance. Hence the need for the measures which are here outlined.

The earwig parasites are being bred and despatched to New Zealand by the Rothamsted Experimental Station, acting on behalf of the Imperial Bureau of Entomology. This Institution is also breeding Ichneumon Fly parasites of the Pear Slugworm for introduction into New Zealand.

Great Britain is receiving her share in the exchange of beneficial insects between countries. From a small amount of material received from France last spring, some thousands of cocoons of a Chalcid Fly known as *Aphelinus mali* have been raised at the Ministry of Agriculture's Pathological Laboratory at Harpenden for distribution to a few chosen places over the country next year, which will become distributing centres in their turn. This Chalcid Fly is a parasite of the Woolly Aphis or American Blight, against which, if it can be successfully established, it should prove a valuable controlling agent. The Fly was at first thought to confine its attentions entirely to Woolly Aphis, but from information recently received from other countries where its introduction has been accomplished, some other kinds of "greenfly" or aphides are falling a victim to it—a point which may add to its usefulness.

It is practically impossible to increase artificially the numbers of a beneficial insect which is either indigenous to, or has been long established in, this country, as its position in the insect world is stabilised; hence the reliance on new introductions. Our ladybirds are instances of very beneficial insects, which, however desirable it may be to increase them by artificial means, offer little hope of an attempt to do so being successful.

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The London Thoroughbred Stallion Show for 1924.

THE Ministry of Agriculture and Fisheries (acting on behalf of the War Office) gives notice that a Show of Thoroughbred Stallions will be held, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, at the Royal Agricultural Hall, Islington, on March 4th, 5th and 6th, 1924.

A Challenge Cup presented by H.M. The King will be awarded for the Champion Stallion in the Show; and a Gold Medal will be awarded by the Ministry to the owner. Sixty King's Premiums (including twelve Super-Premiums) will also be offered for award by the Ministry.

In addition to the King's Premiums, a very limited number of War Office Premiums will be available for award on the recommendation of the County Horse Breeding Committees.

These awards will not be made, however, until the routes of the King's Premium stallions have been arranged.

Copies of the Regulations governing the award of the Premiums can be had on application to the Ministry.

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Lantern Slides on Poultry Subjects.

THE Ministry has arranged for the collection of a set of lantern slides on poultry subjects for the use of county poultry instructors and others engaged in lecturing on poultry-keeping. Some 120 of the most important slides have already been made, and the series will be added to as opportunity occurs for securing suitable subjects.

Any of the slides can be obtained at 10d. each, and a list of the subjects illustrated will be sent to any poultry instructor desiring to purchase them. Explanatory notes in connection with these slides are being prepared by the Ministry and will be issued as soon as completed.

* * * * *

Foot-and-Mouth Disease.—All restrictions imposed in connection with the outbreaks at Morden, Surrey; Dean, Beds; Withernsea and Bridlington, Yorks, have been withdrawn.

The areas in Bucks and Kent to which restrictions were applied on account of the outbreaks near Wendover and Birchington respectively have been contracted.

Statement as to the number of outbreaks of foot-and-mouth disease from 17th November to 12th December (inclusive).

Counties.		*Counties.*	
England and Wales.		Salop	33
Buckingham	1	Stafford	10
Chester	409	Warwick	3
Denbigh	30	Worcester	10
Derby	5	Yorks, N.R.	5
Durham	71	Yorks, W.R.	23
Flint	13	*Scotland.*	
Gloucester	30	Aberdeen	3
Kent	1	Ayr	3
Lancaster	17	Dumbarton	16
Leicester	7	Kinross	1
Lincs, Lindsey	1	Lanark	10
Monmouth	1	Perth	2
Northumberland	45	Renfrew	10
Nottingham	1	Stirling	5
		Total	766

General Restrictions.—Until the 22nd November, on which date the Ministry learnt of the infection of the Newcastle loading docks and market, the Ministry pursued its usual policy of imposing restrictions over a radius of 15 miles from any new centre, with extensions in the case of those centres in which the disease had spread. The danger of a widespread infection resulting from the infection at Newcastle rendered more drastic measures necessary, and on that date the Ministry made an Order entirely prohibiting the movement of stock into, within or through, a large area stretching from the Clyde to Thames and Severn, but excluding Wales. This Order was quickly modified so as to provide for necessary movements of animals by licence, and the holding of fat stock markets with veterinary inspection, the main objects being (a) to stop entirely all store stock markets, and (b) to prevent general long distance movements except under control.

On 1st December this Order was replaced by a new Order, the Great Britain (Foot-and-Mouth Disease) Order of 1923 (No. 5), which revoked all the existing Orders except the Scottish Orders and the North Midlands (Cheshire group) Orders, and divided the area to which restrictions were applied on the 22nd November into (a) 11 infected areas surrounding the actual centres of disease, and (b) a controlled area comprising the remainder of the district subject to the Great Britain Order.

Provision was made in this new Order for the movement by licence of the Local Authority into and within these areas of store as well as fat stock to supply the needs of the population and of the farmers, but no movement was allowed out of the infected areas. Markets and sales were, as before, confined to fat stock intended for immediate slaughter and to displenishing sales of animals on farm premises. No licence was permitted to be granted under the Orders for any movement within two miles of an infected place and no fat stock market was allowed to be held within 5 miles of infected premises. Subsequently movement of fat stock only was permitted from one Infected Area to a slaughterhouse in another Infected Area.

In view of the freedom of the greater part of the Controlled Area from outbreaks of the disease, it was decided to remove all restrictions therefrom as from the 15th December.

Imported Animals.—It was also considered desirable as a precautionary measure to prevent the risk of the spread of disease from store markets by the movement of imported animals from market to market to provide that no licence shall be granted for the movement of imported animals direct to an authorised market from a landing place, but only (1) direct to a slaughterhouse or (2) direct to private premises for detention thereon for a period of fourteen days, instead of for the period of six days prescribed by the previously existing Orders. This was effected by the Imported Animals Order of 1923, which came into force on the 19th November.

Summary.—The number of outbreaks from the period 27th August to the 12th December now totals 1,074, affecting 28 counties in England, 2 in Wales, and 9 in Scotland.

The numbers of animals slaugtered, or authorised to be slaughtered, to 12th December were 35,323 Cattle, 16,283 Sheep, 19,448 Pigs and 31 Goats.

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AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1923.

PRODUCE OF CROPS.

The following PRELIMINARY STATEMENT issued on 24th November last shows the estimated total produce and yield per acre of the POTATO and ROOT CROPS in England and Wales in 1923, with comparisons for 1922, and the average yield per acre of the ten years 1913-1922.

Crops.	Estimated Total Produce.		Acreage.		Estimated Yield per Acre.		Average of the Ten Years 1913–22.
	1923.	1922.	1923.	1922.	1923	1922.	
	Tons.	*Tons.*	*Acres.*	*Acres*	*Tons.*	*Tons.*	*Tons.*
Potatoes -	**2,756,000**	4,012,000	**466,653**	561,177	**5·9**	7·1	6·2
Turnips & Swedes -	**10,828,000**	10.908,000	**858,429**	819,686	**12·6**	13·3	12·4
Mangolds -	**6,956,000**	8,560,000	**401,447**	421,388	**17·3**	20·3	18·9

Potatoes.—Potato planting was rather late in 1923 as spring work generally had been delayed by rainy weather and the difficulty in working heavy land. Planting was done with the soil cold and the crop came up slowly, whilst earlies were cut by May frosts in most parts of the country. The weather early in the season was not very favourable to growth, but the rains of August and September were beneficial. In the north-west and in Wales, however, the continuous autumn rains caused many tubers to rot before lifting. Most of the crop has been stored in dirty condition, but the quality is fairly good as a rule, though the tubers are small. The total production of potatoes on agricultural holdings in England and Wales is estimated at 2,756,000 tons, as compared with 4,012,000 tons last year, and 2,958,000 tons in the very dry year 1921. The average yield per acre is estimated at 5·9 tons, or 1¼ tons less than the very high figure of last year, and one-third of a ton below the average of the ten years, 1913–22. Yields are below average in most counties, but of the chief potato-growing districts Lancashire has the most unsatisfactory crops, the yield in that county being one ton below average. In the Holland division of Lincolnshire and in the Isle of Ely yields were only one-fifth of a ton below average.

Turnips and Swedes.—The dry spell of weather in June and July, which was experienced in most parts of the country, had a bad effect on turnips and swedes. Sowings of turnips were delayed in many districts and plants of swedes and turnips were often patchy, while in a few districts there were many complete failures. In the north conditions were more favourable and a good plant was obtained. Very fair growth was made in the late summer and autumn, but in the eastern and midland counties swedes suffered from mildew. The average yield over the whole country is estimated at 12·6 tons per acre, which is three-fourths of a ton less than last year, but one-fifth of a ton above average. Crops are well over average in the north, and poorest in Oxford, Essex and West Suffolk, where there were many complete failures. The estimated total production of 10,828,000 tons is very little less than last year, the acreage having been increased.

Mangolds.—The sowing of mangolds was late owing to the land requiring much work to obtain a satisfactory seed bed, and germination, though usually regular, was slow. After coming through, the plant remained almost at a standstill for some weeks, as a result of the cold weather, and continued backward throughout the season, so that the roots are small. An unusually large proportion ran to seed. Yields are light in all parts of the country, but are relatively poorest in the north and south-west. The average yield per acre over the whole country is estimated at 17·3 tons, or 1¾ tons under average, and 3 tons less than last year, whilst the estimated total production, 6,956,000 tons, compares with 8,560,000 tons in 1922, and 7,583,000 tons the average of the ten years, 1913–22.

In most districts supplies of winter keep for live stock will be sufficient, any shortage of roots being counterbalanced by the large stocks of hay. In the hill districts of Wales and the north-west of England the position is not satisfactory, as in these areas supplies of hay are short, much of the crop being spoiled by the wet weather and large areas were never cut.

Dairy Exhibition at Milan.—A notice was issued in October last, that an exhibition under the auspices of the Italian Government would take place in Milan in November. The Exhibition was to include all the products of milk, and types of machines, utensils and other articles used in connection with the dairy industry.

The Ministry of Agriculture is informed that the Exhibition has been postponed until April, 1924. The postponement is due in part to the desire of American exhibitors, who were recently occupied with a similar Exhibition at Washington, to be represented at the Milan Exhibition.

British firms who may wish to participate should address their inquiries and applications to the Directzione Generale, Via Tigli 7, Milan, Italy.

Agricultural Machinery Exhibition, Brussels, 1924.—The eleventh agricultural machinery exhibition organised by the Societé de Mécanique et d'Industries Agricoles will be held at Brussels from 16th to 25th February, 1924.

The exhibition will include cultivating, harvesting and food-preparing machinery; milking machines and dairy equipment; land improvement machinery, *i.e.*, drainage, levelling and clearing; forestry appliances; equipment for rural industries; tractors and other agricultural engines and accessories; rural building materials and architecture; small tools and harness; and the application of electricity to the farm.

Fictitious Claims for Fertilisers.—A certain amount of interest has recently been aroused by the report of a discovery in France of a new fertiliser, applicable to both cereals and roots, for which results bordering on the marvellous are claimed. The process, according to reports, consists in steeping the seeds before sowing in a solution, the composition of which is not revealed; and it has been stated that the process has been approved by the French Government. This statement is entirely without foundation. The French Ministry of Agriculture has recently issued a note warning farmers and others interested in agriculture to be on their guard against claims of this nature. It points out that the common sense of agriculturists has generally stood them in good stead in estimating the value of advertisements, while they may always, if any doubt arises, seek the advice of Research Institutes, or of the local advisory centres. The warning thus addressed to French farmers is passed on in the same terms to farmers in this country.

International Dairy Exhibition in Argentina.—An International Dairy and Refrigerating Machinery Exhibition will be held at Buenos Aires in May, 1924, organised by the Argentine Department of Agriculture. Space will be free of charge to exhibitors, and all machinery, implements and general merchandise for exhibition will be free of customs, entries or fees, but exhibitors must arrange their own fixtures and equipment. A copy of the prospectus may be seen at the offices of this Ministry.

The Commercial Secretary to H.M. Legation at Buenos Aires reports to the Department of Overseas Trade that these exhibitions are successful from the local exhibitor's point of view, as they provide useful propaganda at a moderate cost. He considers that there is justification in encouraging British manufacturers to take part when they have local importers or representatives who carry local stocks of suitable machinery and implements which are available for exhibition, or to whom they are prepared to ship suitable specimens for the purpose, and when the importer or representative recommends participation.

Import Regulations as to Plants, Potatoes and Tomatoes from France.—The Ministry has issued an amended Order (The Colorado Beetle Order of 1923) in place of the Order which was made in 1922, with the object of preventing the introduction of this pest from France.

The effect of this new Order is that in place of the declaration formerly required, each consignment of living plants, potatoes or tomatoes shipped from ports in European France to this country must be accompanied by the undermentioned certificate or copy certificates :—

(1) *If grown in France.* (a) For potatoes and for all plants which are subject to the Destructive Insects and Pests Order of 1922, the copy certificates required under that Order. These certificates must be officially endorsed to the effect that the produce was not grown in the neighbourhood of those districts where the Colorado Beetle has existed.

(b) For tomatoes and for plants which are not subject to the Destructive Insects and Pests Order of 1922, an official certificate to the effect that the produce was not grown in the neighbourhood of those districts where Colorado Beetle has existed.

(2) *If grown in other countries and shipped from European French Ports.*—Either the copy certificates required under the Destructive Insects and Pests Order of 1922, or a certificate of origin visé by a Local Authority in the country of origin ; the country and place where the produce was grown must be stated in the certificates.

The certificate or copy certificate must be delivered to an Officer of Customs at the same time as the entry relating to the consignment. In the event of failure to produce the necessary document, a consignment must be destroyed or re-exported by and at the expense of the importer unless its disposal is otherwise authorised by the Ministry.

No certificate or declaration of any kind is now required in the case of vegetables for consumption other than potatoes or tomatoes. The Order came into operation on the 17th December, 1923.

Importation of Plants into Canada.—Nurserymen and others interested in the trade in plants to Canada are doubtless aware that nursery stock may only be imported into that Dominion under permit issued by the Dominion Government. These Permits are issued to the Importers in Canada, and the Ministry is informed that it is unnecessary that a permit be forwarded to this country for return with the consignment to which it relates. The Canadian importer should, however, notify the English exporter of the number of the relative permit and this number should be marked on each container. By adopting this course the entry of consignments into the Dominion will be facilitated.

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REPLIES TO CORRESPONDENTS.

Algerian Phosphate for Wheat.—J.K. asks for information as to the value of ground Algerian phosphate applied to wheat at the rate of 5 cwt. per acre a fortnight before sowing.

Reply: As the phosphate in Algerian phosphate is not soluble in water it could not necessarily be depended on to become available in a sufficiently short time to be of much benefit to the crop. Its availability would be enhanced (1) by extra fineness of grinding; (2) if there were a heavy rainfall; and (3) if the soil were sour. This last condition, however, would be adverse to wheat. Leaflet No. 80 expresses a distinct preference for superphosphate for corn crops, and 3 cwt. of superphosphate would probably prove both cheaper and more effective.

Cowpeas.—L.M. asks whether cowpeas have been tried in England.

Reply: There is no information available as to any actual trials. It is not probable that the crop would succeed in this country.

Thermo-Gen System of Paper Mulching.—N.O. asks for information.

Reply: The method of using paper for mulching, as practised in Honolulu, is described in the Queensland Agricultural Journal, Vol. XVIII, p. 293 (October, 1922), and in the Indian Scientific Agriculturist, Vol. IV, p. 186 (May, 1923). From the former it is gathered that the system has been patented, from the latter, that "Pabco Thermo-Gen is an asphalt-impregnated felt." So far as can be ascertained the system has not been tried in this country.

Plants for Hedges.—P.Q. asks for suitable quick-growing plants for hedges.

Reply: Thorn would be suitable if a quick-growing hedge to keep out cattle is required. If an evergreen hedge is needed, privet (*Ligustrum ovalifolium*) should be planted. *Berberis stenophylla* would be suitable if an evergreen flowering hedge is required.

Analyses of Cooked and Raw Potatoes.—R.S. asks whether the figures given in the Ministry's Miscellaneous Publication No. 32 refer to raw or cooked potatoes.

Reply: They refer to raw potatoes. Similar figures for cooked potatoes are not available, but no serious error will result if the figures for raw potatoes are used. The figures given for roots refer, in every case, to roots in the raw state.

Pig-Feeding in Denmark.—T.U. asks for information.

Reply : The Ministry does not know of any book in English which would give the information. Methods of feeding generally adopted in Denmark apparently vary according to circumstances, but skimmed milk or whey, a supply of which is afforded by the dairying industry, seems always, or practically always, to form part of the ration. As regards the feeding at the Experimental Stations for Pigs the information in the note below, taken from the 9th and 11th reports of these stations, was enclosed :—

Pig Feeding at Danish Breeding Centres.

Bregentved, 1*st September*, 1916—31*st August*, 1917.—Concentrated food, first half-year, barley and maize, half of each ; the small pigs got only barley. In the second half-year, owing to shortness of supplies, no barley was available, and about ¾ maize and ¼ coconut cake was used. As liquid food only skimmed milk was used up to 4·5 kilo. (say 10 lb. or 1 gallon) per pig per day. If this amount was not enough to moisten the concentrated food water was added so as to preserve a proportion between solid and wet food of 1 : 2. A little bone meal was also given. The small pigs are given their concentrated food dry (finely crushed) ; later they go on to wet food. The pigs are given as much as they will eat, but they must eat readily. If a pen leaves its food, it has to go without for one or two feeding times.

Bregentved, 1*st September*, 1921—31*st August*, 1922.—Much the same as above. Small pigs under 30 kilo. (say 66 lb.) only get barley. Skimmed milk reduced to 3 kilo. (say ⅔ gall.)

Elsesminde, 1*st September*, 1916—31*st August*, 1917.—Less milk was given to the older pigs, but all got the same proportion—1 concentrated food to 2·6 skimmed milk or skimmed milk and water. In the case of the big pigs in Class IV, receiving 3 kilo. food units* or over daily, the liquid food remained always the same (5·4 kilo. daily of equal proportions of skimmed milk and water) and the weekly increase was given in the form of concentrated food.

Percentage Composition of Food.

	Food calculated in Food Units. Concentrated. p. c.	Skimmed Milk. p. c.
Class I Under 25 kg. (55 lb.)	70	30
„ II From 25–40 kg. (55–88 lb.) ...	75	25
„ III From 40–55 kg. (88–121) ...	80	20
„ IV Over 55 kg. (121 lb.)	85	15

The food is mixed and allowed to stand about 24 hours before feeding. About 25–50 grammes (0·8-1·6 oz.) of bone meal per pig per day.

Elsesminde, 1*st September*, 1921—31*st August*, 1922.—More or less as above. But the classes in the table are slightly different, the food proportions not being altered. Class II from 25 to 45 kilo.; Class III from 45–65 kilo.; Class IV over 65 kilo.

It is noted that the pigs must clear up all the food at each feeding time :— 6 a.m., 11.30 a.m. and 5.30 p.m

Over Løjstrup (*Jutland*), 1*st September*, 1916—31*st August*, 1917.—The food in previous years consisted of skimmed milk and of equal parts of barley and maize; this year both milk and barley were short. To avoid giving nothing but maize, coconut cake was used (80 p. c. maize and 20 p. c. coconut cake).

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* A kilogramme food unit is the equivalent of 1 kilog. (2·2 lb.) of barley.

Coconut cake in other trials had been shown to have a favourable effect on the firmness of the flesh, and so counteracted the maize. The young pigs did rather badly on a diet including too much maize.

Over Løjstrup (*Jutland*), 1*st September*, 1921—31*st August*, 1922.—No special notes on the feeding for this year are given. The following paragraph, however, occurs:—The shortness of the harvest of 1921 had the effect that the pigs suffered somewhat from want of bedding; added to this was the severe period of frost in January and February. The result was that the pigs suffered from cramp; as soon as this appeared all the pigs in the station were given a dose of "phosphoric oil"; this was so effective that scarcely a single pig suffered any lasting result from the complaint.

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NOTICES OF BOOKS.

International Year Book of Agricultural Statistics.—(*Copies can be obtained direct from the International Institute of Agriculture, Rome*; *or from the Ministry of Agriculture*, 10, *Whitehall Place*, *London*, *S.W.* 1., *price* 8*s. post free.*)—The International Institute of Agriculture at Rome has recently issued the "International Year Book of Agricultural Statistics, 1922." Various changes have been made in the volume consequent on a decision to make it a regular annual publication, the previous issues having appeared at longer intervals. Figures are given for the years 1922, 1921, 1920 and 1919, and instead of the averages for the years 1914-1918, those for the years 1909-13 have been substituted, as affording a more satisfactory basis of comparison than the figures of the war period. The volume includes data showing for each country—(1) area and population; (2) acreage, production and yield of the principal crops; (3) number of live stock; (4) imports and exports of the various agricultural products; (5) prices of agricultural products; (6) freight of cereals and cotton; and (7) production of fertilisers.

Insecticides, Fungicides and Appliances.—(O. G. Anderson and F. C. Roth. London: Chapman and Hall. 15s. net.) The first 175 pages of this book are devoted to a series of laboratory exercises for students taking a course in insecticides and fungicides at an American Agricultural College. They will hardly prove of interest to English growers, except perhaps as evidence of the thorough manner in which the subject of pest control is approached in the United States.

The last 175 pages are given to a general discussion of spraying and spray appliances, which should prove useful to those who are following the development of the subject in the United States, especially perhaps to any who may be tempted to test American methods under English conditions. Fruit-growing periodicals from across the Atlantic are now widely read in England and the glowing accounts published of new methods are apt to be misleading to those accustomed to the sober phraseology of the English Press. The present book carefully avoids such misplaced enthusiasm. For instance, those testing the spray gun on low power outfits will be interested in the statement (p. 239) that an engine of at least 3½ h.p. is necessary to operate one gun, while for two guns, 10 h.p. is desirable, since the minimum working pressure is 250lb. And again, as regards dusting (p. 300):—"The prevalence of dusting among fruit growers in the State of New York varies from ⅛ of 1 per cent. to 5 per cent. . . Probably the dusting of fruit is more prevalent in New York than in other portions of the United States. . . . .

"Dusting is still in the developmental stage and with continued improvement in materials and equipment may have greater possibilities in the future than at present. Present indications are that the future possibilities for dusting may be somewhat greater for low-growing crops than for tall trees."

The book is published by John Wiley & Sons of New York and may be obtained from Messrs. Chapman & Hall, Henrietta Street, at a price of 15s.

Successful Spraying, and How to achieve it.—(P. J. Fryer, F.C.S., F.I.C. London: Ernest Benn, Ltd., 1923, 154 pp., 7s. 6d. net.) This is a handbook for growers, nurserymen, horticulturists, gardeners and amateurs, dealing chiefly with a consideration of the insect pests and fungus diseases of fruit trees and their control.

The author describes the principles of "Contact" sprays for sucking insects and "Stomach poisons" for biting insects.

"Wetting" agents, water properties and the chemistry of spraying are also considered.

A description is given of the more modern hand and power spraying appliances, a short chapter on fumigation, and the work concludes with a summary of the chief insect pests and fungus diseases of fruit trees and small fruit, with suggestions for their individual control.

The book is illustrated with a number of photographs and text figures.

Die Lupine als Objekt der Pflanzenforschung.—(F. Boas and F. Merkenschlager. Berlin: Paul Parey, 1923. 144 pp. 63 illustrations.) This book has a manifold object. It takes the lupin as a text for a description of the processes which take place in the life of a plant, in much the same way as Dr. D. H. Scott used the wallflower in Part I of "Structural Botany." The monograph is also designed to satisfy the increasing interest with which the plant is being regarded by the farmer. In this latter connection there are chapters on the lupin as a collector of nitrogen and carbon dioxide, its use as a soil improver, and its economic value. Copious references and a full index enhance the value of the volume.

Le Soja et son Lait végétal.—(L. Rouest. Carcassonne and Paris, Librairie des Sciences Agricoles, 1921. 157 pp., 8 illustrations, 10 francs.) Whether the cultivation of the soya bean for its seed in this country will ever, under normal climatic conditions, become a possibility is extremely doubtful. Those, however, who wish to attempt to find a successful solution to the problem will gain a considerable amount of assistance from this small volume, which gives an account of the work that has been done in France in this direction.

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ADDITIONS TO THE LIBRARY.

Dairying.

Canada Department of Agriculture.—Bulletin 34 (New Series) :—Dairying in New Zealand and Australia. (33 pp.) Ottawa, 1923. [63.7(9).]

Texas Agricultural Experiment Station.—Circular 30 :—The Practicability of the Milking Machine. (23 pp.) Brazos County, 1923. [63.713.]

Nebraska Agricultural Experimental Station.—Bulletin 181 :—Growth Studies of Dairy Heifers II. Protein Requirements for Growing Heifers. (18 pp.) Lincoln, 1923. [63.711(04).]

Poultry.

Roberts, H. A.—Commercial Poultry Raising. (607 pp.) London : Chapman & Hall, 1923, 15s. net. [63.65(02).]

Evans, E.—The Biology of the Fowl. (160 pp.) The Author, 21, Rydal St., Burnley, 1923, 7s. [63.651(02).]

Hardy, F. W.—The Chemistry of Food : A Manual for Poultry Keepers. (47 pp.) London : National Utility Poultry Society, 1923, 2s. [612.394; 63.65 : 043.]

Engineering.

Cleghorne, W. S. H.—Farm Buildings and Building Construction in South Africa. Second Edition. (360 pp.) London : Longmans, Green & Co., 1922, 25s. [69(02).]

Purvis, G. H.—Agricultural Implements. (115 pp.) [Successful Farming Series.] London : Ernest Benn, Ltd., 1923, 2s. 6d. [63.17(04).]

Economics.

Pigou, A. C.—Essays in Applied Economics. (200 pp.) London : P. S. King, 1923, 10s. 6d. net. [33(02).]

Gardiner, R. S., Central Land Owners' Association.—The Agricultural Landowners' Handbook on Taxes, Rates and Tithe. (110 pp.) London : Estates Gazette, 1923, 3s. net. [336.22; 348.]

Institute International d'Agriculture.—Reglementation des Prix de vente des Produits agricoles. (79 pp.) Rome, 1923, Fr. 5. [338.5; 338.99.]

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SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous.

The Periodicity of Meteorological Factors in Relation to Agriculture, *F. Eredia.* (Int. Rev. Sci. & Pract. Agr., 1923, No. 3, pp. 587-594.) [551.5.]

Danish Experiments in Plant Culture and details about the Trade in Controlled Danish Seed. (Tidsskr. Planteavl, XXIX (1923), 4, pp. 667-672.) [575.4; 63.1951.]

Investigations on the Solubility of Various Phosphates, *H. R. Christensen.* (Tidsskr. Planteavl, XXIX (1923), 4 pp. 513-574.) [63.1672.]

Nitrates and Ammonia from Atmospheric Nitrogen, *E. K. Scott.* (Jour. Roy Soc. Arts, Nov., 1923, pp. 859-895.) [668.6.]

Field Crops.

The Growing of Crops for Silage and some Experimental Results, *J. P. Drew.* (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 144-157.) [63.19832.]

A Study of Factors Affecting the Nitrogen Content of Wheat and of the Changes that Occur during the Development of Wheat, *G. A. Olson.* (Jour. Agr. Res., XXIV, 11, June 16, 1923, pp. 939-953.) [63.311.]

The Water Content of Barley Kernels during Growth and Maturation, *H. V. Harlan* and *N. P. Merrett.* (Jour. Agr. Res., XXIII (1923), pp. 333-360.) [63.313.]

Further Studies on Seed Potato Treatment, *J. C. Gilman* and *J. E. Melhus.* (Phylopath, XIII (1923), 8, pp. 341-358.) [63.512.]

Horticulture.

Commercial Horticulture in Scotland, *D. V. Howell.* (Scottish Jour. Agr., VI, 4, Oct., 1923, pp. 402-418.) [63.5(41).]

Plant Diseases.

Silver Leaf Disease, IV, *F. T. Brooks* and *H. H. Storey*. (Jour. Pomology and Hort. Sci., III, 3, Sept., 1923, pp. 117-141.) [63.24.]

Red Plant in Strawberries and its Correlation with "Cauliflower Disease," *E. Ballard* and *G. S. Peren*. (Jour. Pomology and Hort. Sci., III, 3, Sept., 1923, pp. 142-147, figs. 36-42.) [63.24.]

On the Cause of Rolling in Potato Foliage; and on some Further Insect Carriers of the Leaf-Roll Disease, *P. A. Murphy* (Sci. Proc. Roy. Dublin Soc., XVII, 20, June, 1923, pp. 163-184.) [63.21.]

Transmission, Variation and Control of Certain Degeneration Diseases of Irish Potatoes, *E. S. Schultz* and *D. Folsom*. (Jour. Agr. Res. XXV, 2, July, 1923, pp. 43-118, plates 1-15.) [63.23.]

Fusarium Blight of the Cereal Crops, *D. Atanasoff*. (Wageningen Landbouwhoogeschool Med., XXVII (1923), 4, pp. 1-132, plates 1-6.) [63 24.31.]

Injury to Foliage by Arsenical Spray Mixtures, *D. B. Swingle* and *H. E. Morris*. (Jour. Agr. Res., XXIV, 6, May, 1923, pp. 501-537.) [63-295.]

Live Stock.

The Irish Live Stock Industry, *D. Twomey*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug.. 1923, pp. 125-143.) [63.6(415).]

The Value of Blood Meal as a Pig Food, *E. J. Sheehy*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 169-183.) ([63.60432; 63.64 : 043.]

White versus Yellow Maize as a Pig and Poultry Food, *T. D. Hall*. (S. Africa Jour. Dept. Agr., Oct., 1923, pp. 352-363.) [63.60432.]

Dairying.

The Economics of Milk Recording, *James Wyllie*. (Scottish Jour. Agr., July, 1923, pp. 315-324.) [63.711(*b*).]

The Economic Value of Milk to the Producer, *A. G. Ruston* and *J. W. Dallas*. (Milk Industry, Oct., 1923, pp. 111-118.) [63.714; 63.7(42).]

The Comparative Value of Protein, Fat and Carbohydrate for the Production of Milk Fat, *E. J. Sheehy*. (Sci. Proc. Roy. Dublin Soc., XVII, 24, June, 1923, pp. 211-218.) [63.711(*a*).]

The Use of the Self-Feeder with Young Dairy Calves, *A. C. McCandlish*. (Jour. Dairy Sci., VI, 5, Sept., 1923, pp. 500-508.) [63.62(04).]

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Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W.1.

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THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXX. No. 11.

FEBRUARY, 1924.

NOTES FOR THE MONTH.

New Minister of Agriculture and Fisheries.

Consequent on the formation of a new Government, Mr. Noel Buxton, Member of Parliament for North Norfolk, has been appointed Minister of Agriculture and Fisheries. Mr. W. R. Smith, Member of Parliament for Norwich, has been appointed Parliamentary Secretary.

* * * * * *

Final Report of the Linlithgow Committee.

The publication of the Final Report of the Departmental Committee on Distribution and Prices of Agricultural Produce brings to an end a task which has occupied the Committee for practically a year. Appointed on the 18th December, 1922, the Committee has held 71 meetings and heard oral evidence from 225 witnesses, representative of producers, distributors and consumers. In addition a vast amount of information was collected direct from distributors by means of questionnaires. Four interim reports have been presented dealing with (1) Milk and Milk Products, (2) Fruit and Vegetables, (3) Meat, Poultry and Eggs, and (4) Cereals, Flour and Bread.

The Final Report deals on broad lines with the main problem of marketing and distribution, and is comparatively short, comprising less than 50 pages. In it the Committee has endeavoured to bring together in a summary form some of the principal points which have been brought out in the course of its inquiry, and in particular to supply a reasoned explanation of some of the causes of the difference between the prices received on the one hand by the producer and paid on the

(32944) P.A./R.4. 9,000. 2/24. M. & S.

other hand by the consumer. The Report contains an interesting chapter on co-operation as applied to the sale of agricultural produce—the causes of past failures are discussed and some useful suggestions made as to future developments. The Committee also makes recommendations as to the granting of State loans to producers' organisations, the collection and publication of price statistics and other questions. The concluding chapter of the Report deals with the need for further and continuous investigation into methods of marketing agricultural produce, and generally into the economics of agriculture.

The Report can be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 3s. 1½d., post free.

* * * * * *

Lucerne in the First Century A.D.

IN view of the great value of lucerne as a fodder crop, it might profitably be much more extensively grown, particularly in the southern and midland counties and on soils containing a sufficient proportion of lime. An account of lucerne and its cultivation is given in the Ministry's Leaflet No. 160. As a fodder crop for horses, cattle and pigs, it is highly valuable, while it may be converted into hay which is equal to the best clover hay. Some care is needed to get it established, but once growing strongly, it will yield four cuttings a year for from four to eight years.

In this connection it may be of interest to quote the old Roman writer, Columella, who shows us that even in the 1st Century A.D., agriculturists in Italy possessed a sound knowledge of lucerne and esteemed it very highly. He writes thus:—

"Of the more popular fodder crops, lucerne is the best; once sown it will last for 10 years, and can be mown easily four times, often six times, a year. It enriches the soil; any stock in poor condition will get fat on it; it has a salutary effect on ailing animals; a jugerum (say ⅗ acre) will keep three horses for a year. The method of sowing is the following:—The land on which the lucerne is to be sown in the following spring should be roughly ploughed about 1st October and allowed to weather all the winter. On 1st February go over it again, removing all the stones and breaking up the clods. Then some time in March give it its third ploughing and harrow it. After having thus got a good tilth, lay out plots, like garden beds, 10 ft. wide by 50 ft. long, so that water can be led along the intervening paths, and the labourers can have access on both sides to hoe. Then apply well rotted manure, and sow at the end of April at the rate of a cyathus (about 1/12th pint) of seed to a plot 10 ft. by 5 ft. Immediately after sowing, cover the seed with wooden rakes (harrows). This is a very useful proceeding, as the seeds quickly become parched by the sun. After sowing, no iron implement must touch the crop. And, as I have said, it must be harrowed with wooden harrows and frequently weeded, to prevent other plants killing the unestablished lucerne. The first crop should be taken rather late, after it has shed some of its seed. Afterwards it may be cut young, when it has made some growth, and given to stock, but only sparingly at first, until they get accustomed to it, lest the novelty of the fodder should injure them. For it blows stock and causes full-bloodedness. After it has been cut, water frequently. A few days afterwards, when it begins to shoot again, weed out all other plants. So treated it will last 10 years and give six crops a year." (L. Junius Moderatus Columella, Bk. II, Ch. xi.)

* * * * * *

Rationing of Milch Cows.

THE growth and extension in the south-eastern counties of schemes for the systematic provision of expert advice on the rationing of milch cows are worthy of mention, and some of the factors which have led to this movement may be noticed. It is well known that during, and since, the War a number of new feeding stuffs have come on the market, notably the derivatives of the palm oil industry, formerly almost a monopoly of Germany. In the absence of experience, farmers had little to guide them in the use of these commodities. At the same time the greater attention which is being given to the individual performance of cows as a result of the spread of milk recording, has led to a more general recognition of the need of regulating feeding more in accordance with yield. Experience has also shown that old standards of feeding must be abandoned if the best results are to be obtained from the deep milkers (1,000 gallons and over) which are now to be found in herds. There are authenticated cases in which a heavy-yielding cow has consumed upwards of 20 lb. of concentrated food daily with no traceable evil effects on her constitution. The day is long past, therefore, when cows could be fed economically on an all-over standard. Individual rationing more in accordance with yield and individuality is necessary, and, moreover, expert advice on the compounding of the ration becomes a necessity. This advice cannot be limited to a single occasion. Prices of concentrated feeding stuffs vary from day to day, and it becomes necessary to compare and compound food stuffs which vary not only in their chemical composition but in their comparative cost per food unit as well.

Now, while it must be admitted that Agricultural Organisers and others have always been ready and competent to advise in individual cases submitted to them, it has been found that farmers are, generally, much more ready to receive advice than to solicit it. The scheme which experience has shown to be most successful in the Home Counties is one under which, with the approval and support of the local Milk Recording Society, the Milk Recorder on his periodical visits to a farm fills up a printed form containing full details of the quantities of food being fed to the cows and sends a duplicate to the Adviser (normally the County Agricultural Organiser). The latter, thereupon, applying his expert knowledge, returns the form to the farmer concerned with a report on the suitability of the rations, adding, if necessary, suggestions for modification in order to secure economy and increase the milk yield.

Experience has shown too, that in very many cases under expert guidance, better use can be made of home-produced food, such as roots, hay and straw; and that *over* feeding of *low* yielding cows, and *under* feeding of *deep* milkers, is not uncommon. The savings in cost effected, vary from 1d. to 6d. per gallon,—savings, too, which are immediately apparent in the cash returns from the business of milk production. What must be emphasized, however, is the value of an organised scheme for the provision of advice, founded upon co-operation between a Milk Recording Society and a County Organiser.

In evidence of the extent to which schemes of this description are in operation, and are rapidly extending, in the south-eastern counties, the following brief particulars are appended. They have been supplied by the courtesy of Messrs. McCreath, Garrad, and Jesse, Organisers for the counties of Essex, Kent, and East Sussex, respectively. It is only right to add that the extension of these schemes is largely due to the labours of Mr. J. Mackintosh of the National Institute of Dairying, Reading, and Mr. G. H. Garrad, Agricultural Organiser for Kent, pioneers of the movement in Berkshire and Kent.

Kent.—An organised scheme of advice on rationing has been in operation in Kent for many years. The foundations were laid by Messrs. Mackintosh and Garrad when members of the staff of Wye College under the headship of Mr. M. J. R. Dunstan, now Principal of the Royal Agricultural College, Cirencester. An outstanding and successful feature of the scheme has been the prominence given to comparative cost of production figures. In the year 1922-23, 168 food records were submitted for advice through official Milk Recorders. They related to 100 different herds of which 42 were Shorthorns and 10 Friesian, the rest being either mixed breeds or small herds of Guernseys, Ayrshires and others. An analysis of the returns shows that the cost of food varied from 6d. to 13d. per gallon with a variation of daily yield from 28 lb. to 20 lb. per cow. The most typical results were given by a group of 59 herds in which the cost varied from 8d. to 11d. per gallon.

East Sussex—A rationing scheme was inaugurated in this county in 1919. During last season (1922-23) 413 food records were examined and reported on Of 218 members of the local Milk Recording Society, no fewer than 187 regularly ration their cows on the basis of advice furnished by Mr. Jesse, the County Organiser. In the Fourth Annual Report of the East Sussex Milk Recording Society, a striking illustration is given of the value of studying the feeding and production of a milking herd.

> "During the winter of 1921-22 two herds in the same district were producing milk at a difference in cost (for food alone) of 8d. per gallon. The herds were similar in size but average production per cow per herd varied between 720 gallons per year and 440 gallons.
>
> "The winter production of herd 'A' was 7,917 gallons, costing £313 7s. 7d It would have cost herd 'B' £577 5s. 7d. to produce a similar quantity of milk, a difference of £263 18s. These figures illustrate the impossibility of economic production from a low average herd."

In the case of another large herd, the cost of the ration in January, 1923, was 10½d per gallon: when modified in accordance with expert advice, the cost was reduced to 8½d. per gallon. This was equivalent to a saving in the cost of food for the whole herd of £1,662 in the six winter months. The Local Authority has published a very useful leaflet containing a large number of sample rations for maintenance and production.

Essex.—During last season (1922-23) 255 food records were examined, relating to 47 herds. As a result of the scheme, the average all-over cost per gallon during last winter was only 8½d. per gallon. Another interesting figure is the estimated cost of grazing during the six winter months, viz., £3 15s. 6d. per cow. The progress of the scheme in this county has been promoted by the assistance given by Mr. J. B. Gill, the Secretary of the local branch of the National Farmers' Union.

Similar schemes have recently been adopted in the counties of Surrey, West Sussex, and Hertfordshire. Good progress has been made and there is every reason to expect that the movement will rapidly extend.

* * * * * *

Agricultural Credits Act, 1923.

THERE appears to be some misconception in certain parts of the country as to how, and by whom, the *initial steps* in the organisation of an agricultural credit society should be taken. Under Section 2 of the Agricultural Credits Act, 1923, the Government are empowered to make advances to agricultural credit societies, who, in turn are entitled to grant loans to their members for approved agricultural purposes, for periods not exceeding 5 years. An agriculturist can only benefit under this section by becoming a member of an agricultural credit society, and it rests entirely with local agriculturists to initiate the formation of a credit society for their mutual assistance. If there are persons in any agricultural district who desire to obtain loans under this scheme, their first action should be to meet together and examine the possibilities of founding a society in the district, and of obtaining a sufficient number of members to make it a success. In so doing, the promoters would be well advised to communicate with the Agricultural Organisation Society, 40, Broadway, Westminster, S.W.1, who are ready to help in the formation of credit societies. In addition to this, the Ministry has prepared certain memoranda which may be used as guides, setting forth the necessary steps to be taken, to establish a credit society, to effect its registration under the Industrial and Provident Societies Acts, and to obtain from the Ministry the money advances to which such societies are entitled.

To enable a credit society to be registered under the Industrial and Provident Societies Acts, it is necessary for it to adopt rules setting out its constitution, its method of operation, and the manner in which it must be conducted, in order to conform with the provisions of these Acts and the Agricultural Credits Act, 1923. For the purposes of assisting societies in preparing their rules, model rules which have been approved by the Ministry and the Chief Registrar of Friendly Societies, have been prepared, and may be obtained from H.M. Stationery Office, Imperial House, Kingsway, W.C.2.

* * * * * *

Scholarships for Children of Rural Workers.

THE Ministry hopes to announce at an early date the conditions under which scholarships for the sons and daughters of agricultural workers will be awarded for the next academic year. The value of these scholarships is such that no outlay on the part of parents or scholar is necessary during the tenure of the scholarships. The scheme, which was instituted two years ago, has achieved a considerable measure of success, and it is most desirable that the facilities afforded by it should be widely known. At present, 13 students are taking degree courses in agriculture or an allied subject at Universities; 20 are taking diploma courses at Agricultural Colleges; and about 70 are attending Farm Institutes, etc., for short courses in agriculture, horticulture, dairying, or poultry-keeping.

* * * * * *

Agricultural Research Exhibits at the British Empire Exhibition.

EVERY effort is being made to ensure that the Agricultural Research Exhibits at the British Empire Exhibition will be intelligible and interesting to both the agricultural and the urban public. It is realised that it is not sufficient to get together a representative, judiciously selected, well displayed and labelled exhibit. The experience of museums and picture galleries has conclusively proved that a collection of this kind may be, as far as the general public is concerned, a mere mausoleum. Those who are scientifically trained can pick their way through such a collection and discover the material of which they are in search, but only because they are trained to know what to look for. Until a few years ago, it was for this class and for this class alone that museums catered: now, however, museums have begun to make an appeal to the widest possible circle, and they have found that the one sovereign method of throwing open their collection to the public, is to engage the services of competent guide lecturers who will, at intervals during the day, explain the significance of selected specimens in the galleries.

The forthcoming agricultural exhibit at the British Empire Exhibition will therefore be explained and demonstrated to the public on the lines adopted by the most popular museums. With the assistance of the Research Institutes and Agricultural Colleges of Great Britain—who are contributing the bulk of the collection—an exhibit has been brought together which will not only illustrate all the aspects of modern research, but which explains the scientific side of modern farming, the forces which make for success, and the forces which have to be kept in check.

Fuller details of the exhibit will appear in later issues of the *Journal.* Here it must suffice to say that eight principal divisions have been made:—Animal breeding and nutrition (including dairying); veterinary science; soils; plant breeding; plant pathology; horticulture; agricultural machinery; and agricultural economics. The divisions will be so arranged in the hall as to tell a continuous story—of the soil and its manuring and working, of crops and animals in health and disease, and the methods of combating disease. Qualified guide-lecturers will attend to explain at stated times the significance of the specimens and pictures, to supplement printed programmes and guides, and to put into words the story which to the initiated the cases will tell.

* * * * * *

The Annual Index Number of Agricultural Prices.

THE decline in the prices of agricultural produce, which was very sharp in 1921 and 1922, was much less marked in the past year, the average of the prices of all commodities sold off farms in 1923, after making due allowance for the relative importance of the different articles, being 57 per cent. above the average of 1911-13. The decline as compared with 1922 was therefore only 12 points, as compared with reductions of 50 and 78 points respectively in the previous two years:—

Year.	*Percentage Increase in the Prices of Agricultural Produce as compared with the three years 1911-1913.*
1915	27
1916	60
1917	101
1918	182
1919	158
1920	192
1921	119
1922	69
1923	57

Prices generally have been at about the same level in 1923 as in 1916, but grain, hay and potatoes were much below the 1916 level, and milk, dairy produce, eggs, fat sheep, fruit and hops considerably above. The decline as compared with 1922 was not due to any great extent to falling prices during 1923 —in fact the monthly index numbers of prices during the greater part of 1923 showed comparatively little variation—but mainly to the higher prices in the first eight months of 1922, after which a sharp fall took place. During the last four months of 1922 the average increase over pre-war was very little different from that of the corresponding period of 1923.

Most commodities were cheaper than in 1922, and potatoes were relatively the cheapest, being only 13 per cent. above pre-war. During the first six months of the year, when the very heavy crop of 1922 was being marketed, wholesale potato prices in the large towns were lower than in 1911-13, being about 30 per cent. below from April to June. The new crop, which was small, has sold at much higher figures, realising from 60 to 90 per cent. above pre-war.

On the average cereals were appreciably lower in price than in 1922, but wheat was 1d. per cwt. and barley 10d. per cwt. dearer, with oats 5d. per cwt. cheaper, in December than a year earlier. Apart from potatoes, cereals on the whole showed a relatively smaller increase over 1911-13 than any other commodity, averaging only 26 per cent. above. Hay was also comparatively cheap, being only 30 per cent. above pre-war, but since the new crop, which was heavy, came on the market prices have declined, and during November and December were no higher than before the War.

Over the whole year milk averaged 74 per cent. above 1911-13, or only 5 points less than in 1922, and was one of the dearest commodities. Butter showed little change from the previous year at 59 per cent. above pre-war, but cheese which was relatively cheaper than butter in 1922 advanced to 69 per cent. above pre-war. The percentage increases as compared with 1911-13 in milk, butter and cheese respectively were more uniform in 1923 than in any year since the end of the War. Eggs declined from 93 per cent. above 1911-13 in 1922 to 68 per cent. above in 1923, but at the end of the year were dearer than in December, 1922. Poultry also showed a fairly similar decline.

Fat cattle, sheep and pigs all realised reduced prices, but sheep remained at a higher level than other fat stock. Fat cattle prices were comparatively steady during the year and at the close were practically the same as at the end of 1922, but in the case of sheep the usual autumn rise did not bring prices up to the level of December, 1922. Fat pigs have become much cheaper during the past year. At the end of 1922 they were practically double the pre-war price, whereas in December, 1923, they were only about 40 per cent. above.

Fruit crops in 1923 were poor and prices were consequently high, averaging more than double 1911-13. Vegetable prices generally followed much the same course as potatoes, being low in the first half of the year and comparatively high in the second half, and over the whole year averaged 48 per cent. above pre-war against 96 per cent. above in 1922. Hops yielded lighter crops than in the previous year, and the average price was fixed by the Hop Control at £13 per cwt. against £10 10s. per cwt. for the 1922 crop.

Wool showed a further rise in price in 1923, and at the summer wool sales averaged 44 per cent. above pre-war, as compared with only 14 per cent. above in 1922.

Percentage Increase in the Prices of Agricultural Produce during the years 1916 to 1923. as compared with the average of the three years 1911-13.

Commodity.	*1916.*	*1917.*	*1918.*	*1919.*	*1920.*	*1921.*	*1922.*	*1923.*
Wheat	79	132	123	123	147	119	46	30
Barley	88	128	108	167	215	84	41	19
Oats	68	151	149	164	187	72	47	35
Fat Cattle	58	105	111	132	163	127	63	51
Fat Sheep	57	97	110	130	187	117	100	87
Fat Pigs	67	126	166	176	230	128	87	65
Hay	52	57	87	157	192	51	40	30
Potatoes	88	137	79	135	206	132	79	13
Milk	57	91	151	200	203	163	79	74
Butter	36	77	109	115	199	115	61	59
Cheese	49	103	133	169	140	71	48	69
Poultry	36	69	159	127	141	112	92	73
Eggs	59	111	258	255	239	142	93	68
Fruit	38	54	311	218	279	183	88	117
Hops	19*	9*	93	113	105	111	23	52
Wool...	46	62	74	208	253	16*	14	44
Beans and Peas	70	170	377	219	188	96	80	86
Vegetables	51	138	157	157	119	146	96	48

* Decrease.

* * * * * *

Foot-and-Mouth Disease.

THERE has been a steady decrease in the number of premises found to be affected with foot-and-mouth disease in recent weeks. In the week ending 29th December, the number was 320; in that ending 5th January, 256; in that ending 12th January, 193; and in the week ending 19th January, 115. A similar decrease is to be noted in the figures for Cheshire, where the disease is far more prevalent than in any other county in Great Britain. This will be seen from the following figures from Cheshire:—Week ending 29th December, 212; week ending 5th January. 160; week ending 12th January, 110; and in the week ending 19th January, 63. The improvement in the position is also shown in the fewer cases of suspicion of disease reported to the Ministry, and in the very few new centres of disease which are being discovered. It is too early still to prophesy that the outbreak will speedily be terminated, but the situation gives distinct hope that it will at any rate be possible, if the present policy can be pursued during the whole course of the outbreak, to prevent any further large conflagration such as that which has occurred in Cheshire.

Up to and including the 21st January, the total number of outbreaks since the present epidemic started on the 27th August last is 2,403. The numbers of animals slaughtered, or authorised to be slaughtered, are—Cattle, 82,147; sheep, 28,056; pigs, 38,143. These figures represent a percentage of 1.1 in the case of cattle, 0.14 per cent. in the case of sheep, and 1.4 per cent. in the case of pigs, of the total number of animals in each category in Great Britain. The estimated gross compensation payable for slaughtered animals up to that date was £2,524,000, of which about £325,000 is expected to be returned from the salvage of healthy carcasses.

An addition to the exception to the general policy of slaughter made in the case of pedigree herds has been adopted. It concerns the dairy stock in certain badly stricken areas of Cheshire which are on farms where the buildings and surroundings are such as, in the Ministry's view, make it possible to isolate without danger to other stock, or to the ultimate success of the stamping-out policy. The Ministry is prepared in these cases to adopt isolation in the same way as it has been adopted in suitable cases where pedigree stock are concerned. It will be understood that the Ministry must be the judge of what cases are suitable for isolation in the districts of Cheshire in which this concession will be operative, and that where the Ministry prescribes isolation there will be no compensation paid for losses which may be sustained. This alteration does not constitute any departure from the stamping-out policy, or a reversion to a policy of isolation. The Ministry is more than ever convinced that the principle of slaughter is the only policy which can safely be adopted in the generality of cases where foot-and-mouth disease is discovered.

TURNIPS, SWEDES AND KOHL RABI FOR STOCK FEEDING.

J. R. BOND, M.Sc.,
Agricultural Organiser for Derbyshire.

History.—Turnips were apparently grown as a garden vegetable in this country long before they became a field crop. During the 16th and 17th centuries their adoption for field cultivation was advocated by writers, especially Sir Richard Weston, who had seen turnips grown extensively in Holland and Germany. At that time, however, most of the arable land in Britain was worked on the open field system, wherein each occupier held scattered strips unfenced from his neighbours' land and open to the live stock of the parish after corn harvest. With the extension of enclosures, turnip cultivation gradually spread during the 18th century, effecting in its progress a transformation in farming methods and imparting those characteristics which came to be regarded as the distinctive features of modern British agriculture. Swedish turnips were introduced in 1777; but it was not until about 1850 that this kind had largely displaced the softer sorts of turnip in such an important arable county as Lincolnshire. The Kohl rabi, formerly called the Hungarian turnip, was introduced into Britain about 1830.

Turnip husbandry as we now know it, including the practices of drilling, ridging, singling and horse hoeing, is little more than a century old in many parts of Britain. It reached its zenith about 50 years ago; since when, with the general decline in arable cultivation, the turnip acreage has steadily diminished. In Denmark, however, where turnip cultivation was learnt from Britain, the acreage under this crop has steadily increased during the same period.

Influence of the Turnip.—Lord Ernle in the preface to his *English Farming Past and Present*, says that the introduction of the field cultivation of turnips was as truly the parent of a social revolution as was the introduction of textile machinery. Previously arable land had been bare fallowed after every two corn crops. When turnips and clover were introduced in the rotation, food became available for the winter feeding of greater numbers of cattle and sheep; and fresh meat began to replace salt flesh in the human winter diet. The improvement in the quality of British live stock was also intimately connected with the extension of turnip cultivation.

The maintenance of greater numbers of sheep and cattle improved the condition of the soil, with the result that the yield of corn was more than doubled. The substitution of bare fallowing by manuring, as the means of fertilising the soil, brought into cultivation light land, which, although unproductive under the corn and fallow rotation, was found to be very suitable for turnip husbandry. Large areas of light land in Norfolk, Lincolnshire and Northumberland, which had previously been waste, were so reclaimed during the last quarter of the 18th century. Lastly may be mentioned the fact that the need for better implements with which to clean and prepare the tilth for turnip sowing brought about an improvement in the farmer's tillage equipment.

Turnips and Sheep.—There are districts where arable farming is pursued with sheep as the main object and here turnips are specially required to provide winter food for the flock. The principal source of income in typical British arable farming is, however, corn crops. Where the soil is light and the rainfall low, it is considered necessary to fold sheep on the land to bring it into the firm and enriched condition requisite for the production of good yields of grain. The turnip crop provides part of the food necessary for winter folding, while its cultivation affords an opportunity for cleaning the land, without the loss of organic matter associated with bare fallowing: light dry land is very dependent on the liberal addition of organic matter.

It is under such conditions as the above that turnip husbandry is most extensively practised—in the sheep and corn districts of Norfolk, Lincolnshire, Notts, Yorkshire, Durham, Northumberland, Suffolk, Hampshire and Dorset. The climatic conditions in these counties are not so favourable to the growth of turnips as in the moist western counties, where much heavier yields per acre are obtained; the greatest areas of turnips are grown, however, where there is the largest acreage of corn, where the roots are required for sheep feeding, and where the crop may be folded on the field in winter without harm but with benefit to the land.

Turnips alone are not an ideal or even a good ration for sheep. Sheep are adapted for dry conditions and for a ration in which the proportion of dry matter to water is about 1 : 3. In roots there is one part of dry substance to about nine parts of water; hence sheep on turnips should have a liberal allowance of dry fodder. Experiments indicate that the best quantity of roots to feed per week is about the weight of the sheep. The consumption of excessive quantities of roots is best checked by the provision of sufficient dry fodder, especially clover hay: almost as much dry matter in the form of hay and concentrates should be fed as the sheep receives in its ration of roots. When transferring sheep from grass (which has a dry matter to water ratio of about 1 : 3½) to soft turnips (1 : 10) the provision of dry fodder is specially necessary.

Typically, a weekly ration of 100 lb. of swedes is accompanied by an allowance of 5 lb. of hay and 5 lb. of cake and corn. Although the nutriment in roots and hay is mainly carbohydrate matter, the supplementary concentrated food given to sheep being fattened on turnips need not be high in protein; in fact the feeding of too liberal an allowance of protein is dangerous to sheep.

In some districts it is not customary to pit or even to lift and cut roots for sheep; and, as regards the softer kinds of turnip fed before Christmas, pitting and cutting are not of great advantage. With swedes, however, which begin to be folded about the time when hoggs are undergoing dental changes, fingering is desirable. Further, when the roots are lifted and cut, the crop is consumed with less loss and waste, and the practice avoids the troubles caused by the excessive consumption of grit associated with the gnawing of dirty shells. In recent years, there has not been sufficient frost to cause much trouble through the feeding of frozen turnips; but it is considered good practice always to have sufficient roots lifted and stored to carry the flock through any ordinary period during which the roots and ground might be frost bound.

Turnips and Cattle Feeding.—The production of corn under a permanent system of agriculture necessitates converting the straw into manure to maintain the condition of the soil, especially its humus content. The ordinary method of effecting this conversion is to fatten cattle indoors in winter on roots and concentrates together with as much straw as they can eat and tread down. Typically about half the turnip crop grown on the farm is thus carted to the steading and utilised for cattle feeding, the other half being fed to sheep on the land. Where, as on the heavier soils, the proportion of straw crops to roots is commonly 3 to 1, a greater proportion, even to the whole of the root crop, is fed in the cattle yards.

The quantity of turnips in the daily ration of fattening cattle varies, according to the supply of roots available, between 40 and 120 lb. per head. As to what is the best allowance for fattening purposes, experiments suggest that about ¾ cwt. per head per day may be recommended for the ordinary 2½ years old cattle used in winter feeding practice. This ration is also a convenient one for the typical feeding farm; the root crop yielding 15 tons per acre and the straw 1¼ tons, and with 3 acres of straw per acre of roots, the daily allowance of straw for food and litter may be 22 lb. and that of the roots 88 lb. per head. Where the proportion of roots to straw crops is 1 : 2 and half of the roots are fed on with sheep, the above-stated allowance of 22 lb. of straw per day would be accompanied by a ration of 66 lb. of roots.

As regards the method of feeding roots to the older fattening cattle, Scotch practice is largely in favour of giving the roots whole and the straw unchaffed. In England, however, many feeders pulp the roots and mix with the pulp a considerable quantity of straw chaff and part or the whole of the concentrates. Although the latter practice is often recommended, there is reason to believe that the foods are better masticated and ruminated if fed with less preparation. In an experiment at Garforth in 1903-4, bullocks fed with sliced swedes and yellow turnips gained 2.07 lb. per head per day as compared with a gain of 1.64 by a similar lot which received the same quantities of roots, straw and concentrates—but with the roots pulped and mixed with the chaff and meals. Similar results have been observed in practice with dairy cows.

The "corn and horn" farmer grows roots for the main reason that his land requires a thorough working and cleaning once every four or five years; the root crop, especially turnips, allows of this while producing a return in food material to cover part or the whole of the cost of its cultivation. The returns from winter fattening of cattle are, however, commonly so small that farmers do not as a rule devote land primarily to the production of fattening material. The root crop is, therefore, restricted to the area entitled to be cleaned in the proper course of rotation rather than extended at the expense of other crops.

Under conditions that are not favourable to the safe and cheap production of good turnip crops, arable farmers are constantly seeking ways of avoiding the necessity for growing roots. Four such methods have been tried: 1. Farming without cattle, the straw being sold off and the loss in manurial constituents being compensated by the return to the farm of artificials and town manure. 2. Converting the straw into artificial yard manure. 3. Cattle feeding without roots, their place being taken by additional concentrates, of which treacle is one. 4. Substituting the root crop with a crop of tares for hay or ensilage and cleaning the land by bastard fallowing after harvesting the tares.

Turnips and Cattle Rearing.—McCombie, of Tillyfour, wrote: "I make it an almost universal rule (and I have never departed from the rule except with a loss), that I will graze no cattle except those that have been kept in the open straw-yard, and have been fed exclusively on turnips and straw. If you can get them off yellow turnips it will be decidedly to your advantage." As regards the comparative merits of chemically equivalent weights of swedes and yellow turnips, experiments at and in connection with Cockle Park in 1911-13 showed that two-year old shorthorns made smaller gains in winter but much more rapid progress in summer after wintering on a ration that included yellow turnips instead of swedes. Yearling blue-greys, however, gave the opposite results.

Experiments were carried out at Cockle Park to compare the immediate and after-effects of three methods of wintering and feeding yearling blue-grey cattle. Each lot received in winter a basal ration of 6 lb. hay and 1¾ lb. soya cake, but in addition Lot 1, wintering out, had (in 1911-12) 2 lb. maize meal and 2¼ lb. straw, or (1912-13) 1 lb. cotton cake and 3 lb. hay; Lots 2 and 3 received 25 lb. swedes or 33½ lb. yellow turnips respectively, and were housed at night. The weekly gains in lb. per head were as follows:—

Year.	*Feeding.*	*Winter.*	*Spring.*	*Summer.*	*Average.*
1911-12.					
	Lot 1. (root substitute)	10·0	2·2	13·4	10·3
	„ 2. Swedes	8·0	4·0	15·6	10·5
	„ 3. Yellow Turnips	8·4	2·4	14·9	10·2
1912-13.					
	Lot 1. (root substitute)	1·86	1·86	15 25	6·73
	„ 2. Swedes	6·30	5 87	15·0	9·22
	„ 3. Yellow Turnips	6·62	3·33	13·75	8·42

Turnips and Dairy Farming.—The most thorough investigation of the importance of roots in the production of milk has been made in Denmark. Commencing in 1884 with pigs, and in 1887 extending his feeding trials to dairy cows, Fjord obtained results that completely changed the Danish farmers' attitude towards root crops. The acreage under turnips, swedes and mangolds in Denmark was 95,000 in 1888, but by 1919 it had increased to 678,000; and Fjord's advice to grow a statute acre of roots for every three adult animals in the herd has been adopted as standard practice.

Fjord's feeding trials showed "that roots had a very considerable value; that roots could replace corn and oil cake in the food of both cows and pigs without changing their growth or the production of milk: that the addition of roots to the food increased the milk yield of cows and made them lay on flesh at the same time; and that the larger yield of milk produced by giving roots was not caused by a greater proportion of water in the milk, but that the larger yield was of milk of the same richness as the milk produced without roots . . . . that 1 lb. of dry matter in roots has the same feeding value as 1 lb. of corn . . . . and that the dry matter in mangolds and swedes had the same feeding value, pound for pound, when fed to milch cows" (Faber: *Forage Crops in Denmark*).

In three experiments with cows at Bangour, Edinburgh, Lauder and Fagan compared the effect on the yield and composition of milk caused by substituting 72 lb. of turnips for 6 lb. of protein-rich meals, in a normal ration of 40 lb. of turnips, 15 lb. of hay and 10 lb. of concentrates. Each lot of cows had 15 lb. of hay, but whereas Lot 2 had 10 lb. of concentrates and 40 lb. of roots, Lot 1 had only 4 lb. of meals with 112 lb. of roots. The meals fed varied and the heavy turnip ration each year contained about ½ lb. less of digestible protein than the normal ration fed to Lot 2. For this reason it might have been expected that the turnip ration would produce rather less milk, as in fact it did; but, contrary to common expectation, the more watery turnip ration in each experiment produced the milk with the higher fat content. The experimenters suggest that "the easily digestible carbohydrates contained in the turnips are specially suitable for fat formation." The actual yields and fat percentages were as follows:—

	Lot 1. Turnip ration.		*Lot 2. Ordinary ration.*	
Experiment.	*Total yield of milk. lb.*	*Average percentage of fat.*	*Total yield of milk. lb.*	*Average percentage of fat.*
I. (1909) 10 cows per lot ; 9 weeks ...	15,240	3·49	15,818	3·09
II. (1910-11) 11 cows per lot ; 8 weeks ...	13,920	3·55	14,069	3·35
III. (1911-12) 9 cows per lot ; 10 weeks ...	14,345	3·68	15,637	3·26

Turnip Plant.—One of the objections often urged against the feeding of turnips to dairy cows is that they taint the milk. Dunne, writing of Danish practice (this *Journal*, April, 1916, p. 58), remarks that "the risk of imparting a bad flavour to the butter, popularly called 'turnip flavour,' disappeared as soon as the pasteurisation of milk became general. Since the advent of pasteurisation, the use of swede turnips as a food for dairy cows has been steadily extended in Denmark. . . . Every Danish dairyman is convinced that roots are an indispensable constituent of an economic ration for cows. . . . When roots can be added to the ration in liberal quantities the cost of the ration is reduced to the minimum, and a maximum profit is obtained." It is significant that in recent years little has been heard of the matter of "turnip flavour." This may be due to the wide extension of the pasteurisation process in the British whole-milk trade. Replies from some of the largest firms engaged in the milk trade, however, contain the opinion that pasteurisation does not completely eliminate the said flavour. The Dairy Manager of the Derby Co-operative Society, which retails about 4,000 gallons of milk per day, is of opinion that the aeration of the milk during its proper passage over the cooler is a means of eliminating "turnip taint." A Derbyshire farmer's wife, who has won many and important prizes with her butter, informed the writer that she had never had trouble with "turnip taint" since she introduced the cream separator, although she often had such difficulties in the old days of hand skimming.

Roots or Hay?—In some districts there is a tendency to rely too much on hay as the basis of the winter rations of dairy cows. A critical study of such rations and their results in comparison with those which include a good allowance of roots, shows that there are limits to the usefulness of hay in milk production. The feeding of large quantities of fibrous fodder taxes the digestive capacity and energy of the cow and reduces her yield. On fair pasture, a cow can extract the 15 lb. of starch equivalent required in the production of 3 gallons of milk by the consumption of 27 lb. of dry matter in pasture grass. But to extract the same quantity of nutriment from hay, she would have to consume 42 lb. of dry matter, the digestion and utilisation of which would obviously divert the energy of the beast from her main function of milk production. In a good dairy ration the starch equivalent per 100 lb. of dry matter is about the same as that in pasture grass, to obtain which proportions it is necessary to limit the allowance of dry fibrous fodder to 15 or 17 lb. and supply the rest of the nutriment in the form of concentrates or roots.

A good root crop produces about three times as much effective milk-producing matter as a good crop of hay, as the following comparison (omitting tops and aftermath) indicates :—

	Digestible Protein.	*Starch Equivalent.*	*Milk-producing capacity.*
	lb.	*lb.*	*gallons.*
Swedes, 20 tons	493	3,270	545
Meadow hay, 30 cwt.	181	1,035	173

Composition of Turnips.—The amount of dry substance per 100 lb. of roots, or the percentage of dry matter is, in kohl rabi about 12.5, in swedes about 11.5, in yellow turnips about 9.5, and in soft white turnips about 8.0. In each kind, however, a difference of 1 per cent. either above or below these figures may occur, the chief causes of variation being seasonal influences, variety, and size of roots. Turnips grown in Scotland do not show higher percentages of dry matter than English-grown roots.

The dry substance of turnips is somewhat similar in nutritive value to that in oats and other carbohydrate concentrates. The higher lime-content of swedes in particular, however, is noteworthy in view of the recent fuller recognition of, the importance of sufficient lime in the diet of dairy cows. At Wisconsin it was found that cows fed on lime-poor rations generally aborted or brought weakly calves and that these troubles could be averted by correcting the deficiency. Lime salts are also believed to have a specific favourable action on the reproductive organs; but, whether this or the vitamin content of turnips is the cause, it appears to be the case that cows breed more regularly where the winter ration includes a proper allowance of roots instead of too much wet grains and concentrates.

The following table, compiled from figures published by Dr. Crowther and Professor Wood, will facilitate the comparison of turnips with, other farm food stuffs :—

Food Stuff.	Per 100 lb. of the natural food stuff.		Per 100 lb. of the dry substance.		
	Moisture.	Dry Matter.	Digestible Protein.	Starch Equivalent.	Lime.
	lb.	lb.	lb	lb.	lb.
Oats	13·3	86·7	9·2	68·6	0·1
Swedes	88·5	11·5	9·6	63·5	0·9
Soft turnips ...	91·5	8·5	7·1	51·7	0·5
Kohl rabi ...	87·3	12·7	5·6	65·3	1·5
Mangolds ...	88·0	12·0	5·8	51·7	0·4
Pasture grass ...	80·0	20·0	12·5	56·0	2·0
Meadow hay ...	14·3	85·7	6·3	35·9	1·2

SUB-SOILING TRIALS IN ESSEX.

WITH the co-operation of the East Anglian Institute of Agriculture, Chelmsford, the Ministry laid down last winter and spring a series of sub-soiled plots upon which it is proposed to take observations for five years. A further series is about to be laid down in the Oxford district. As a result, it is hoped that a good deal will be learned of the effect of sub-soiling, about which very little is really known at present.

A general description of methods was given in this *Journal* in January, 1923,* which will serve as an introduction to the present note on the Essex trials. This note relates to one season's work only, and will not discuss the details either of the operation or the results to the soil and the crop: such a discussion must wait until much more work has been done and many more observations taken. But the practical results of the Essex trials, measured by the crops, have been so markedly and uniformly successful as to warrant the publication of the figures of crop yields, in order that farmers who have not already done so, may consider whether it is not worth while to experiment on a field or two.

A few words may be said as to the scale of the trial. There were eight fields used in all, with a total area of 66 acres. The trial plots in the winter of 1922 had an average area of 0.852 acre, and those for the spring of 1923, 0.777 acre. These fields were chosen because they offered representative soil conditions from comparatively light land to heavy clay, viz.:—Sand and Gravel, Brick Earth, Boulder Clay and London Clay. Potatoes were grown on two fields of Sand and Gravel, and one field of Boulder Clay. Wheat was grown on London Clay and barley on Brick Earth.

It should be explained that the fields were divided into strips, that the control plots (which were ploughed and not sub-soiled) were situated between the sub-soiled plots, and that subsequent to ploughing and sub-soiling, each plot on the same field received identical treatment. It sometimes proved impossible to harvest the whole of each trial plot separately, and in such cases, sample plots were taken at regular intervals, and from the yield so obtained the total yield of the whole plot was calculated.

It will be seen that there are two types of tables for each crop. The first is for the un-sub-soiled plot which has a final column giving the average value of the crop. The second is for the sub-soiled plot which has a final column giving the value of the increased or decreased yield due to the sub-soiling; an example of this is shown in table 1 for Kerr's Pink Potatoes. The average value of the potatoes per acre for the control plot is £25 19s. 2d., whilst the average value of the increased yield for the sub-soiled plot amounts to £7 4s. 9d. per acre.

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* Preliminary Report of a Trial of Sub-soiling Devices at Tonbridge, Jan., 1923, p. 911.

Table I.—Kerr's Pink Potatoes.—Fields A and B were situated approximately 12 miles apart, and were sub-soiled in the winter of 1922 and spring of 1923 respectively. It will be seen that in field A sub-soiling at a depth of 7 in. produced the best results, but in field B sub-soiling at 5 in. was most remunerative. For Boulder Clay 9-in. sub-soiling proved best. There was a smaller proportion of chats to ware on all the sub-soiled as against the control plots, and in all cases, sub-soiling produced an increased yield. The effect therefore of sub-soiling was clearly to accelerate maturity—a point which will be kept under observation.

Table II.—King Edward Potatoes.—King Edward potatoes were grown on a portion of the sand and gravel fields A and B referred to in the previous table. The results agree with those obtained for Kerr's Pink potatoes, and show that for field A 7-in. sub-soiling, and field B 5-in. sub-soiling, produced the best results. An extremely small proportion of chats to ware was obtained on both fields

Table III.—King George Potatoes on Boulder Clay.—The yield of potatoes is small by comparison with other fields, but this is probably due to the extremely dry condition of the soil when the potatoes were planted. The sub-soiled plots, however, show an increase in every case over the control plots. It will be seen that no great difference in the additional yield was shown between the sections sub-soiled at different depths.

Table IV.—Barley on Brick Earth.—The barley referred to in this table was sown very late, and only 16 weeks elapsed before harvesting. In this case sub-soiling at 9 in. produced the greatest additional yield.

Table V.—Wheat on London Clay.—The whole of the field of London Clay to which the figures relate was mole drained, and a portion sub-soiled by steam tackle. The crops from the sub-soiled and un-sub-soiled parts of the field were harvested and thrashed separately.

COSTS, YIELDS AND VALUES, ALL PER ACRE.

TABLE 1.

POTATOES. KERR'S PINK.

(a) **Control Plots.**

Soil.	*Depth of Ploughing.*	*Cost of Ploughing.*		*Yield.*		*Value.*		
				Ware.	*Chats.*			
	Inches.	s.	d.	Tons.	Tons.	£	s.	d.
Sand and Gravel (A)	5	10	4	1·18	·725	24	8	9
Sand and Gravel (B)	5	10	4	7·15	1·6	42	10	6
Boulder Clay	5	14	2	1·81	·48	10	18	3
Average	5	11	7	4·38	·935	25	19	2

Sub-soiled Plots.

Soil.	*Depth of Sub-soiling.*	*Extra Cost of Sub-soiling.*		*Gain or Loss (—) in Yields.*		*Gain or Loss.*				
				Ware.	*Chats.*	*Weight.* *Ware.*	*Weight.* *Chats.*	*Value.*		
	Inches.	s.	d.	Tons.	Tons.	per cent.	per cent	£	s.	d.
Sand and Gravel (A) ...	5	6	3	2·69	·141	64·33	19·44	15	1	6
Sand and Gravel (B) ...	5	5	9	2·23	·05	31·19	3·12	12	7	3
Boulder Clay ...	5	4	9	1·07	—·063	59·11	—13·12	5	15	2
Average ...	5	5	7	1·999	·043	51·54	3·14	11	1	2
Sand and Gravel (A)	7	5	5	1·49	—·005	35·64	—·69	8	3	9
Sand and Gravel (B)	7	7	2	3·73	—·25	52·16	—15·62	20	0	3
Boulder Clay	7	5	1	·98	—·104	54·14	—21·66	5	3	7
Average	7	5	11	2·07	—·12	47·21	—17·66	11	2	6
Sand and Gravel (A)	9	10	2	·265	—·265	6·34	—35·17	0	19	6
Sand and Gravel (B) ...	9	7	4	2·9	—·14	40·56	—6·2	15	15	0
Boulder Clay ...	9	6	3	·91	—·007	50·27	—1·45	4	19	10
Average	9	7	11	1·36	—·134	32·39	—14·27	7	4	9

TABLE 2.

POTATOES. KING EDWARD.

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.		Value.
			Ware.	Chats.	
	Inches.	s. d.	Tons.	Tons.	£ s. d.
Sand and Gravel (A)	5	10 4	5·59	1·02	38 7 5
Sand and Gravel (B)	5	10 4	6·75	1·28	46 8 8

(b Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.		Gain.		
			Ware.	Chats.	Weight.		Value.
					Ware.	Chats.	
	Inches.	s. d.	Tons.	Tons.	per cent.	per cent.	£ s. d.
Sand and Gravel (A) ...	5	6 3	3·14	·05	56·1	4·9	20 10 2
Sand and Gravel (B) ...	5	5 9	1·03	·36	15 2	28·1	7 8 4
Average	5	6 0	2·085	+ ·205	35·65	16·5	13 19 3
Sand and Gravel (A) ...	7	5 5	2·03	— ·185	36·3	— 18·1	12 16 6
Sand and Gravel (B) ...	7	7 2	4 33	— ·06	64·1	4·6	28 5 4
Average	7	6 3	3·18	— ·062	50·2	6 75	20 10 11
Sand and Gravel (A) ...	9	10 2	·525	— ·14	9 3	— 13·7	3 2 8
Sand and Gravel (B) ..	9	7 4	1·68	— ·01	24·8	·78	10 18 0
Average	9	8 9	1 102	— ·065	17·05	— 7·24	7 0 4

TABLE 3.

POTATOES. KING GEORGE.

(a) Control Plots.

Soil.	*Depth of Ploughing.*	*Cost of Ploughing.*	*Yield.*		*Value.*
			Ware.	*Chats.*	
	Inches.	s. d.	Tons.	Tons.	£. s. d.
Boulder Clay	5	14 2	2·34	·36	13 11 9

(b) Sub-soiled Plots.

Soil.	*Depth of Sub-soiling.*	*Extra Cost of Sub-soiling.*	*Difference in Yield.*		*Gain.*		
					Weight.		*Value.*
			Ware.	*Chats.*	*Ware.*	*Chats.*	
	Inches.	s. d.	Tons.	Tons.	per cent.	per cent.	£ s. d.
Boulder Clay	5	4 9	1·36	·07	58·12	19·44	7 12 5
Boulder Clay	7	5 1	1·29	·143	55·12	39·72	7 7 8
Boulder Clay	9	6 3	1·30	·12	55·55	33·33	7 7 10

TABLE 4.

BARLEY

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.	Value.
	Inches.	s. d.	lb.	£ s. d.
Brick Earth	5	8 1	1.174	4 14 4

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.	Gain.	
				Weight.	Value.
	Inches.	s. d.	lb.	per cent.	£ s. d.
Brick Earth	5	3 3	220	18·7	0 17 8
Brick Earth	7	3 0	244	20·8	0 19 8
Brick Earth	9	6 3	348	29·6	1 8 0

TABLE 5.

WHEAT.

(a) Control Plots.

Soil.	Depth of Ploughing.	Cost of Ploughing.	Yield.	Value.
	Inches.	£ s. d.	Bushels.	£ s. d.
London Clay	5	1 11 1	44·36	12 5 5

(b) Sub-soiled Plots.

Soil.	Depth of Sub-soiling.	Extra Cost of Sub-soiling.	Difference in Yield.	Gain.	
				Weight.	Value.
	Inches.	s. d.	Bushels.	per cent.	£ s. d.
London Clay	7	13 11	11·64	26·2	3 4 5

General Results.—The tables show that *in the first year every sub-soiled plot produced an increased yield, the value of which was greater than the extra cost of sub-soiling over ploughing.* A recent examination of the various plots suggested that the effects of sub-soiling will last for some further considerable time.

The figures indicate that the best depth of sub-soiling may vary from field to field even in the case of soil apparently similar in character. This is a point which is receiving investigation, but the results certainly suggest that any farmer who proposes to practise sub-soiling, would be well advised to experiment at different depths for the first year and determine by the results obtained the most profitable depth for his own particular conditions.

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CO-OPERATIVE MARKETING OF MILK IN THE UNITED STATES.

THE distribution of milk has always been one of the most difficult problems of organisation which agriculturists have to face. It is one towards the more satisfactory solution of which great efforts have been made in the United States during recent years.

The difference between producers' and consumers' prices, and the high cost of distribution, are points which are well known to characterize the milk trade in this country. A very full analysis of the causes leading to this state of affairs is given in the Interim Report on Milk and Milk Products of the Linlithgow Committee.* In the United States no less than in this country have the characteristics referred to been the general rule. The milk middlemen in America absorb a very large proportion of the consumers' price. It has been said that on the average of the available data for 1920-1922, the distributor gets more than 60 per cent., the producer less than 32 per cent., while transport costs absorb about 8 per cent. of the consumers' price.

The milk distribution trade in the United States has long been well established and financially powerful, and it is hardly a surprise that the progress of co-operative milk marketing has been marked by many violent struggles with the existing privately owned distributive undertakings. The first stages in the development of the co-operative movement have been almost exclusively confined to the formation of producers' collective bargaining associations. Such associations did not, however, meet with unqualified success. A bargaining association which sold its milk to private dealers seldom found it easy to conduct business without creating hostility amongst the distributors. Moreover, they did nothing to overcome the real economic wastefulness of the existing system.

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* Cmd. 1854, price 3s. net, 3s. 1½d. post free. Obtainable from H.M. Stationery Office, Kingsway, W.C.2.

Nevertheless, much of the initial work of organising co-operative milk marketing was done by these associations. Between 1887 and 1889 there was a very rapid development of the movement amongst farmers towards the formation of associations for the collective sale of milk, and a further impetus was given to it during the last decade of the 19th century. Most of these organisations actually came into being to " fight the Milk Trusts " which operated in the principal cities of the United States, and their early efforts were frequently accompanied by violent disputes, " Milk strikes," and other disturbances.

As in most other branches of agriculture in America, by far the most widespread movement in co-operative milk marketing occurred during and after the War. In the neighbourhood of nearly all the large cities of the United States which have a population of 200,000 or over, co-operative milk selling associations were formed by local producers during the years 1915-1919. They were very different in form and in the objects at which they aimed, from the co-operative marketing organisations which have been developed in the orange trade in California, in the dried fruit trade, in the tobacco industry, and other branches of agriculture. They still consisted primarily of bargaining associations, which fixed prices by the system of meeting the distributors, and attempting to come to an agreement. No attempts were made at these early stages to control the market on the lines of the Californian Fruit Growers, or to carry out the final stages of distribution under the direct control of the co-operative organisation. Their success was the kind of success that generally attends collective, as contrasted with individual bargaining. They did in fact obtain a better price for milk for the individual producer than he had been able to secure by his own unaided efforts, but not without serious opposition from private interests. Like other organisations for collective bargaining, their ultimate weapon was to strike, and some sensational milk strikes of this character actually occurred during the war period in Chicago, Boston and New York.

(1).—An example of this type of organisation is afforded by the Twin City Milk Producers' Association, which was founded in 1916. In its early stages it was successful in obtaining for its members a definitely higher price for milk than generally prevailed in neighbouring unorganised districts; but it was soon recognised that the plan of collecting bargaining only went a small distance in solving the problem, and in December, 1919, a Stock Co-operative Society was formed with a capital of $500,000 to provide plants to manufacture the surplus milk into various milk products. At the present time the Association has 4,200 members, most of whose dairies are within 40 miles of two cities, St. Paul and Minneapolis. It handles 80 per cent. of the milk of the district. The organisation embodies the usual principle of long term contracts under which all its members are bound to deliver their production of milk and cream, other than home requirements, to the Association. The milk is delivered each morning to a Receiving Station or plant of the Association, the amount needed by dealers being usually specified by means of contracts with the Association to take a stated amount of milk daily. A small surplus is retained for emergencies, and the balance remains at the country plants and is manufactured into cheese, butter, and other milk products.

This Association within its limited sphere has made very considerable progress. In 1921 it handled approximately 14 million gallons of milk, of which over 9 million gallons were sold to distributors, the bulk of the remainder being manufactured. Although the Twin City Milk Producers' Association confined its activities within the sphere indicated above, indirectly it led to the development of a further stage towards the co-operative control of distribution. The milk " drivers " of Minneapolis organised the Franklin Co-operative Creamery Association, to carry out the distribution of the milk from the Producers' Association, and to operate in conjunction with it. After starting with only 18 delivery wagons, by the spring of 1921 it had grown to 180 wagons delivering in all approximately 50 per cent. of the milk supplies of Minneapolis.

(2).—The most important co-operative milk marketing organisation in the United States is the Dairymen's League Co-operative Association (Inc.) of New York, one of the largest co-operative enterprises in America. It was organised in 1921, and during the first year of its existence, handled about 250 million gallons of milk, in return for which it distributed some 52,000,000 dollars amongst its members, who number approximately 65,000. At the end of March, 1922, the Association was operating 128 manufacturing plants, and its members were organised at 944 receiving stations. During the latter year, the turnover of the Association amounted to approximately 6,000,000 dollars per month.

The Dairymen's League Co-operative Association succeeded an organisation known as the Dairymen's League, which was inaugurated as far back as 1907, primarily as a producers' protective association. In 1916, the latter body came into conflict with the New York Distributors, and after a short but severe struggle, succeeded in establishing working arrangements for its produce. Between that year and 1921, the Dairymen's League Co-operative Association (Inc.) began to handle the milk of more than 50.000 farmers under contracts which enable it to pool all its members' milk produced for market. The Association was empowered to dispose of the milk to distributors or to manufacturers of butter, condensed milk, cheese, ice cream, etc., or to manufacture it in plants owned by the Association. The producers at each of the 944 established points are organised into local corporations, existing primarily for the purpose of facilitating co-operative purchases of feeding stuffs and supplies, and for representation purposes in the Association.

The Association, like many similar co operative undertakings in the United States, is a non-stock organisation, which is incorporated under the Co-operative Laws of New York providing for marketing associations formed on this plan. It is governed by 24 directors, each of whom represents a district.

The existence of farmer-owned milk depots, operated by experts in the employ of the Association, insures that there is no artificial interference with, or closing down of, the plant, as long as the farmers have milk to sell. It means that surplus milk is manufactured into the more advantageous forms of milk products, and is not shipped to the cities, as in former days, to force down the price of fluid milk received by the producer. The effect is that the milk market is stabilised to a greater degree, and in consequence a better price is assured to the farmer.

The Association returns to its members all the proceeds from the sale of milk, less the expenses for administration, and deductions for new plants and working capital. Each member receives the same base price per 100 lb. of milk, but with differentials for freight, butter fat, and hygienic quality, by means of 12 monthly milk cheques. Whatever is left as a residue of the year's business, goes to the members in a thirteenth cheque. The method of financing the Association, is to take certain amounts each month from the returns to producers, and to issue interest-bearing certificates of indebtedness due in 5 years. During the first 11 months of the Association's life more than 5,000,000 dollars were thus retained, to be used by the Association for the purchase and equipment of plant, etc.

(3).—A third example of a similar organisation is the New England Milk Producers Association, a non-stock organisation incorporated under the laws of Massachusetts. Its general structure is not unlike that of the Dairymen's League Co-operative Association (Inc.). Primarily it is a bargaining association. It has, however, one or two distinctive features. The problem of surplus milk is handled according to a plan devised by the Federal Milk Commission during the War—a plan which has been continued since that time by agreement between the producers and dealers. In effect, this arrangement leaves the surplus milk to be handled by the dealers, the price paid by the dealers depending on the use to which it is put. The Association and the dealers, in the first instance, come to terms as regards the price which is to be paid for the milk used in the regular trade. The price of milk used for other purposes is determined by other factors which have to be agreed upon. The dealers report to a disinterested party each month, indicating the amount of milk which is produced and the amount of by-products made. This party—at present the Commissioner of Agriculture—computes, in accordance with an approved system, the amount of milk represented in by-products, and the price; the remainder represents the milk used in the whole milk trade, and for which the price which had been arranged by the Association and dealers, is paid.

(4).—An instance of a more advanced development on co-operative lines is afforded by the combined enterprise of the Frazer Valley Milk Producers Association, and the Frazer Valley Dairies, Ltd. The former comprises 1,800 dairymen, whose farms are situated in the valley of the Frazer River, and supply milk to Vancouver. The Association, which has a capital of 750,000 dollars, and deals with 90 per cent. of the milk in this district, receives the milk from its members under continuous contracts, which can only be revoked after one year's written notice. About one-fifth of its capital is used to finance the construction and equipment of condenseries, creameries and cheese plants handling the milk which is not supplied direct to Vancouver; a "surplus" plant situated in Vancouver deals with the seasonal fluctuation in the Association's milk supplies, while the remainder of its capital is used in the subsidiary organisation, the Frazer Valley Dairies, Ltd. The Association sells its fluid milk both to the latter and to some other distributors, the Frazer Valley Dairies, Ltd. buying its milk from the Association at prices fixed by the latter. It distributes 65 per cent. of the Vancouver milk, and returns the bulk of its profit to the parent Association. It has been stated that the costs of this distributive organisation have been very low, and the result of the combined arrangement has been to ensure to the milk producers a substantially larger proportion of the consumers' price than had previously been the case.

Note.—It is perhaps not without interest to compare the progress made in co-operative milk marketing in the United States with other branches of the co-operative movement, a short account of which was given in the January issue of this *Journal.* It is easy to see that in the case of milk one of the chief problems still remains unsolved. Co-operation has done little to gain control over the retail distribution of fluid milk in the towns, or to reduce the cost of this service. One of the difficulties in the development of the retail side of the business is not far to seek: the capital required for distribution in large cities is very great, and the characteristic of American co-operative enterprise is that it is usually operated on very little capital, the non-stock non-profit association being the common type. A second difficulty is the highly organised state of the existing retail business and the high degree of technical skill required in its management. Nevertheless, many authorities consider that the co-operative sale of milk by farmers and its retail distribution by ordinary dealers is not a satisfactory combination, and it seems probable that the next few years will see the development of co-operative enterprise in retail milk distribution in the United States.

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EARLY ESTIMATES OF GRAIN GROWING IN GREAT BRITAIN.

PERSONS interested in the history of British Agriculture often wish to obtain some early statistics of the acreage and production of crops in this country before such statistics were officially collected in 1866-67. The following note gives such information on this subject as is available.

The most detailed estimate of the distribution of agricultural land in England available at the beginning of the 19th century was one made about 1771 by Arthur Young in his "Tour through the East of England." No great value can, however, be attached to his figures as they were based on the mistaken assumption that the total area of England and Wales amounted to about 47 million acres, whereas more correct measurements subsequently showed an extent of only 37,324,000 acres. As, however, he is the only writer of the period who attempted to estimate the production of grain, the figures have some interest as showing his opinion of the supplies available at that time from home sources. The figures are as follows:—

ENGLAND.

	Area. *Acres.*	*Production.* *Quarters.*
Wheat	2,795,008	8,385,024
Barley	2,623,885	10,495,540
Oats...	1,483,065	7,044,558
Peas	513,369	1,475,935
Beans	399,287	1,647,058

In 1797 Mr. Middleton, in a Report on the State of Agriculture in Middlesex prepared for the old Board of Agriculture, made an estimate of the proportion of each 10 million acres of arable land occupied by the different crops, founded, he says, "on my own observations in most of the counties of England." He followed, however, Arthur Young in calculating the total area of England and Wales at 47 million acres and placed the arable acreage at 15 millions. Dr. Beeke in 1800 (*Observations on the Produce of the Income Tax*), taking the total area at 38,500,000 acres, reduced Middleton's arable estimate proportionately to 11,491,000 acres; and Mr. W. T. Comber in *An Enquiry into the State of National Subsistence* (1808) seems to have applied Middleton's proportionate figures to this area and arrived at the following result:—

	Acres.
Wheat	3,160,000
Oats and Beans	2.872,000
Barley and Rye	861,000

McCulloch in the edition of his *Statistical Account of the British Empire* published in 1837 gives figures of the average yield per acre of the undermentioned crops, deduced from the county surveys of the old Board of Agriculture made between 1793 and 1815. These may be compared with Arthur Young's estimate adopted in the table of production given above:—

	Board of Agriculture Surveys. *Bushels per acre.*	*Arthur Young's estimate, 1771.* *Bushels per acre.*
Wheat	21	24
Barley	32¼	32
Oats...	35½	38
Rye	23¾	—
Peas	28	23
Beans	25¾	32

Applying the Board's figures to Mr. Comber's estimate of the wheat acreage the production of that crop at about the beginning of the nineteenth century would seem to have been about 8,400,000 quarters.

In the case of Scotland, an estimate of the area under cultivation was made in the General Report on Scotland published by the Board of Agriculture in 1814. No figures were given of production, but the area of the principal crops was as follows:—

	Acres.
Wheat	140,095
Barley	280,193
Oats	1,260,362
Rye	500
Beans and Peas	118,000
Potatoes	80,000

If the wheat yield of Scotland is taken at the same figure as England, viz., 21 bushels per acre, the production of wheat in Scotland would be 368,000 quarters, making a total for Great Britain of 8,768,000 quarters. This may be compared with the statement of Tooke, in his *History of Prices*, that the produce of an ordinary crop of wheat in this country at the beginning of the last century was estimated at nearly 9 million quarters.

In 1814, however, Arthur Young in giving evidence before the Select Committee on Petitions relating to the Corn Laws made an estimate on a rather different basis, and gave a figure for the production or consumption of wheat, barley and oats in the United Kingdom. His calculation was as follows:

	Qr.
ENGLAND AND WALES:	
Out of a population of 10,791,000, 8,500,000 persons consumed wheat as bread at the rate of one quarter per annum ...	8,500,000
Consumption not as bread	100.000
	8,600,000
Less net imports (average of 1811—1812)	187,162
	8,412,838
Add for seed, one-ninth	934,759
Annual growth=3,399,126 acres at 22 bushels per acre	9,347,597
Barley and oats, occupying half as much land again as wheat, would represent 5,098,689 acres at 36 bushels	22,944,100
SCOTLAND:	
Wheat (? barley) and oats (consumption)	5,401,283
IRELAND:	
Wheat (? barley) and oats (consumption)	3,375,000
Total production of wheat, barley and oats in the United Kingdom	41,067,980

"Oats," he observes, "are much consumed in Scotland, the amount in quarters much exceeding the consumption of wheat per head." In regard to Ireland, the basis for the support of the population was the potato, and he allows 18 bushels per head of wheat and oats for 1½ million persons as representing the total consumption of a population of 5 millions.

The importance of wheat as the principal food stuff of this country, and its extremely high price in some of the years between 1800 and 1815, caused great attention to be given to facts relating to its cultivation and importation, but it does not appear that up to the year 1816 any attempt was made at a quantitative annual estimate of the amount available to meet the requirements of the population. As late as 1821 the Select Committee on the State of Agriculture assumed "what they believed to be then true," that the annual produce of corn, the growth of the United Kingdom, was upon an average crop about equal to the annual consumption.

Subsequently in 1828 an estimate was made by Mr. Jacob, Inspector-General of Corn Returns, in his Second Report, made to the Board of Trade, on Agriculture and the Trade in Corn in Northern Europe, 1828. He put the annual consumption in Great Britain, exclusive of seed, at 12,000,000 qr. and estimated the quantity of the produce according to a scale "based upon extensive inquiries." He also at the same time made an estimate of the supply and demand for the years 1816 to 1827, which it may be interesting to reproduce:—

	In thousands of qr.						*Price per qr. in Harvest year.*	
Year.	*Stock in hand.*	*Imports*	*Produce.*	*Total available.*	*Estimated requirements for food and seed.*	*Stock remaining in Hand.*	s.	d.
1816	6,150	772	9,000	15,922	12,480	3,442	97	10
1817	3,442	1,739	11,700	16,881	12,670	4,211	84	6
1818	4,211	733	12,000	16,944	12,850	4,094	78	5
1819	4,094	403	13,500	16,997	13,030	3,967	68	5
1820	3,967	567	16,000	20,534	13,210	7,324	57	0
1821	7,324	463	12,600	20,387	13,390	6,997	51	5
1822	6,997	400	13,500	20,897	13,570	7,327	46	4
1823	7,327	367	11,000	18,694	13,750	4,944	59	9
1824	4,944	411	11,500	16,856	13,900	2,956	64	6
1825	2,956	811	12,700	16,467	14,110	2,357	61	1
1826	2,357	701	13,000	16,058	14,290	1,768	56	1
1827	1,768	957	12,500	15,225	14,470	755	53	2

In regard to this statement Mr. Jacob observed: "No one can be more aware than myself of the errors to which an implicit confidence in the preceding table would lead. . . . It may, however, deserve a considerable degree of attention as a clue to the development of some important views. . . . The relative productiveness of the several years, being framed from as great a variety of facts as could be collected is not likely to be very far from an accurate view. The statements relating to absolute quantities are certainly only unauthoritative conjectures. There are no satisfactory notices in this country of the number of acres destined to grow bread corn nor even of the number under arable cultivation. There are no means of forming any judgment of what the average acreable produce of wheat is. . . . It is equally difficult to determine what is the annual consumption; in the table it is estimated at somewhat more than 6 bushels and a half per person.''

McCulloch in his Statistical Account of the British Empire (1854) gives an estimate for the year 1846, as follows:—

	England and Wales.		Scotland.	
	acres.	qr.	acres.	qr.
Wheat	3,800,000	15,200,000	350,000	1,225,000
Barley	1,500,000	6,375,000	450,000	1,800,000
Oats	2,500,000	12,500,000	1,300,000	6,500,000

About this period, the demand for statistical information as to production developed, and the apprehension of an impending famine in Ireland in 1847 led to the systematic collection in that country of returns both of acreage and produce. In 1853, and in several subsequent years the Board of Trade, at the suggestion of the Highland Society, attempted as an experiment the collection of agricultural statistics both in England and Scotland. An estimate was made in 1854 for the whole of England and Wales on the basis of reports obtained by Poor Law Inspectors from 11 counties. In the case of Scotland, complete returns seem to have been obtained in 1855, 1856 and 1857.

According to these estimates, the acreage of grain and potatoes in England and Wales in 1854 and in Scotland in 1855 was as follows:—

	England and Wales. (1854) acres.	Scotland. (1855) acres.
Wheat	3,808,000	191,000
Barley	2,668,000	186,000
Oats	1,303,000	934,000
Potatoes	192,000	147,000

Estimates were also made by Sir John Lawes as regards the wheat acreage and production of the United Kingdom from 1852-53 (see *Journal of the Royal Agric. Soc.*, 1893). In 1866, the official collection of statistics of the area of crops and number of live stock was commenced, but it was not till 1884 that this was supplemented by official estimates of production.

HOUSING OF CASUAL LABOUR.

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In the issue of this *Journal* for July, 1919, there appeared a most interesting account of the starting and development of raspberry cultivation in the neighbourhood of Blairgowrie. The author of that article, Mr. J. M. Hodge, has since dealt with the whole subject in a still more comprehensive manner in "Raspberry Growing in Scotland."* This book contains a record of past achievement and a survey of future possibilities, and the whole position is reviewed from every standpoint—agricultural, economic and national. In the course of a recent visit to the raspberry growing districts of Perthshire, undertaken with the object of gaining some insight into the conditions under which Scottish fruit pickers live and work, much help was derived from Mr. Hodge's written narrative, in which adequate consideration is given to the problem of labour. The additional information furnished in person by Mr. Hodge and Mr. Keay (who has also had much to do with these fruit-growing enterprises), contributed materially to understanding of the present situation. Viewed in the light of past history, existing arrangements at Blairgowrie illustrate the continuous progress which has been made in the matter of accommodation for casual labour.

In endeavouring to give some brief description of the housing of such seasonal workers in Perthshire to-day it will be convenient to deal (1) with properties in individual ownership, and (2) with those in joint ownership.

Mr. Hodge's statement shows that raspberry growing, on a commercial scale, started in a small way at Blairgowrie in the closing years of the 19th century. At first the labour problem was practically non-existent, for the villages yielded a sufficient supply of pickers. As the area under fruit cultivation steadily increased, it became evident that it would be necessary to import labour for the harvest season, and the "housing question" became acute. It is related that one enterprising grower "erected corrugated iron buildings, fitted with wooden beds and supplied with straw and blankets. Others followed his example and the fields became dotted with more or less respectable sheds for the housing of the pickers" With some slight modification this would still apply to the provision for seasonal labour made by the average individual grower in raspberry growing areas to-day, if establishments recently visited by the writer may be regarded as typical.

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* Published by the Scottish Smallholders' Organisation, Ltd., 1921.

Accommodation Provided by the Smaller Growers.—*Camp I* catered for a relatively small number of pickers and the accommodation was correspondingly limited in extent and character. The buildings, of corrugated iron, included messroom, kitchen and sleeping huts. The latter contained wooden beds (fashioned on the lines of bunks), filled with loose straw and provided with army blankets, fumigated at the end of the season. Two persons slept in each bunk. Ablutions were performed in buckets with water from taps outside the huts. Earth sanitation was available. A good fire was kept burning in the kitchen stove, where the kettles were boiled. The messroom was small and bare, but as the camp was near Blairgowrie there was no difficulty about the purchase of provisions. An attendant exercised general superintendence over the camp. While primary needs were satisfied at this camp, it was felt that it represented the minimum of comfort and that the standards of order and cleanliness might, with advantage, have been higher.

Camp II instanced progressive improvement. More workers were located there, and the buildings, though resembling those of Camp I, were of greater capacity. The rooms were larger and lighter, and the general "lay out" more satisfactory. Sleeping accommodation took the form of large dormitories for single men and single women respectively and of separate compartments for families. These huts were also fitted with wooden beds of the usual box-like design, plentifully supplied with straw. Lockers, whose tops could be used as tables, were a new and useful feature of the furnishing. Sanitary provision for the men adjoined that for the women, but, by order of the local Sanitary Officer, entirely separate arrangements were to be made in the future

Camp III, the property of a local landowner, proved to be the scene of a special experiment. Between 20 and 30 women., students from Glasgow and Edinburgh, secure a cheap and pleasant holiday every year by undertaking the picking of fruit at this particular plantation. Excellent wooden buildings, with good floors and a plentiful supply of windows, have been erected for their reception. A large and pleasant room was in use as combined kitchen, pantry and messroom. The services of a cook are retained throughout the season and 12s. per week is all that the pickers are called on to contribute in return for their comfortable quarters and good food. The spacious dormitory was lined, on either side, with a double row of bunks, and personal property was placed on a long narrow table or form, fixed in the middle of the hut. Connected with the hut was a bathroom containing lavatory basins and two baths, the hot water for which was fetched from the kitchen boiler. There were three w.c.'s. The camp as a whole was a very pleasant example of the satisfactory arrangements which can be made when a limited number of persons of a selected type are employed year after year.

At *Camp IV* a two-storeyed wooden building had been put up for the accommodation of a small number of special pickers (*e.g.*, Girl Guides and others). In this case the ground floor was used for messroom, kitchen, etc., and the upper storey as a dormitory. Here again it was clear that temporary quarters can be made very comfortable indeed for a small and homogeneous body of pickers.

Adapted Farm Buildings.—In the foregoing instances the buildings had all been erected specially for housing purposes. An instructive visit was paid to a larger farm some miles from Blairgowrie, which may be described as *Camp V.* This exemplified the adaptation of ordinary farm buildings on a large scale and illustrated the special arrangements which remoteness of situation entails. While the floors of the older buildings were necessarily rough, the cleansing and whitewashing of walls had helped to produce a habitable atmosphere in places originally designed for very different uses. Space available in the lofts and ground-floor buildings already existing had been supplemented by a large hut of corrugated iron. The men's quarters were separated from those of the women. The usual type of wooden box-bed, raised well above the ground, was installed throughout the dormitories and completed by straw mattresses and blankets. Ablutions were performed in pails, and earth sanitation was arranged.

Two pleasing features of the encampment, which went far to alleviate the difficulties otherwise inseparable from an isolated situation, were the canteen provided by the owner and the recreation tent organised by the Church of Scotland. The former was a large room built of corrugated iron with concrete flooring and good lighting, which served as a combined kitchen and messroom. Such of the pickers as did not cater for themselves could buy cooked food (soup, potatoes, etc.), and eat it there. A grocery store was also open in the canteen, and so everything essential to the pickers' housekeeping was obtainable on the premises. The large tent, furnished with forms, benches and piano, and provided with magazines, etc., was in charge of a neighbouring Minister of the Church of Scotland. Camp V stands out in memory as an example of the way in which ordinary farm premises may, with extensions, be utilised to meet the requirements of a new industry springing up on the land.

Larger Schemes of Accommodation.—*Essendy.*—Turning to conditions on lands in joint ownership, the first ambitious housing scheme on co-operative lines was inaugurated at Essendy, an estate some miles from Blairgowrie, in 1905. Appreciation of the fact that raspberries cannot be grown continuously on the same land has now resulted in temporary discontinuance of fruit culture at Essendy, and only a small proportion of the buildings there are in use at present. The scheme, however, remains, even in a state of partial disuse, an impressive contribution to the solution of the problem of housing casual labour. It is surprising that accommodation so extensive and of so excellent a type could have been erected at a cost which, even allowing for pre-war prices, was so inconsiderable. Between 1905 and 1908 the sum of £3,441 was disbursed for housing at Essendy—a comparatively small sum when the character and capacity of the settlement is taken into account.

Some re-distribution having been found necessary, the buildings are now grouped in two main portions in beautiful surroundings on a tract of moorland sloping down to Marlee Loch. The fruit fields are readily reached from one or other of these groups; such accessibility was indeed found to be essential to any satisfactory housing scheme. The accommodation comprises a large number of sleeping huts, each capable of holding 20 persons All these huts are of substantial appearance, some being built of brick, others of corrugated iron. By judicious management, it proved possible to erect the former at a cost of £75, the latter at £50 per hut in pre-war days. At the end of each a small room or recess fitted with basins makes an admirable ablution room, and the shelter and privacy thus secured must be greatly appreciated. Earth sanitation is provided. The three spacious canteens, built of corrugated iron with excellent lighting and flooring, are greatly in advance of previous standards of accommodation for the agricultural worker.

When not required for meals, they are used as recreation rooms. The canteens are served by well-planned kitchens, equipped with suitable stoves and boilers and well provided with larder and storage space. The general arrangements are such as should secure quick and efficient service of meals. Grocery and stationery stores are maintained (though now on a diminishing scale) on the premises and regulated by a system of ticket distribution.

In the heyday of raspberry growing at Blairgowrie it is related that a matron and thirty servants attended to the material wants of the pickers, that a doctor, cleansing officer and a policeman ensured their health and safety, and that week-day concerts and religious services on Sunday ministered to recreation and spiritual welfare. "Add to these things," says Mr. Hodge, "that the settlement housed the pickers of all the growers on co-operative lines, each grower having a *pro indiviso* interest in the buildings in proportion to the acreage of ground he owned; that the pickers were secured not for the individual but for the associated growers and allocated among them according to their needs; and that the produce of the colony was sold by a salesman appointed for the purpose, and you have a scheme which as far as I know has no counterpart . . . ." The visitor from England, contemplating the adequacy and attractiveness of the whole design at Essendy, appreciating the sound and sensible lines on which it has been carried out, and realising the good sense and vision, the regard for real efficiency and ultimate economy which prompted both conception and execution can only echo the regret that so satisfactory a scheme has not been more widely copied as yet in the south.

Aberuthven: The Latest Development.—At Aberuthven, in the Parish of Auchterarder, on the estate of the Hall Farming Company, it proved possible to see, under the guidance of Mr. Neil Young, the manager, what may be regarded as the latest example of Scottish schemes for housing such casual labour. Raspberry cultivation is at its height at Aberuthven and the activity there is comparable to that which existed in earlier times at Essendy. Experience gained at the latter place has proved of value in developing Aberuthven. It had become apparent that pickers must be near their work, and it was further understood from the outset that, as the amount of labour required would be large, workers of differing types would need to be considered. As a result there are eight housing centres on the 400 acres now under raspberries. At the time of this visit there were over 1,000 pickers (chiefly coming from Glasgow) in residence, and it was expected that this number would be very considerably exceeded during the six weeks which constituted the season. Of the eight centres, three were allocated to industrial schools, four to women and children and one to men.

These eight camps at Aberuthven are all delightfully situated and are mostly specially built, though there is one case of adapted buildings (lofts, etc.). The usual building is of corrugated iron, with numerous windows and good wooden floors. The sleeping quarters consist of huts, equipped with 9 beds (of the wooden box variety), straw-filled mattresses and army blankets. Since each bed holds two people, 18 were housed in each hut, but the local Sanitary Officer is now limiting the residents to 13, in accordance with a bye-law which provides that accommodation erected in the future shall allow 300 cubic feet of air space per person.

Drying rooms are provided for the pickers' wet clothing. Ablutions are performed in pails with water obtained from adjacent taps or streams. Sanitary conveniences (on the pit system with use of disinfectants), are provided at each centre in the proportion of one to every twenty residents. There is a matron in charge at each camp, who is responsible for order, cleanliness and general discipline. Her own hut is part of the camp in question.

Each centre includes a canteen (capable of holding about 300 people), built of corrugated iron with a good floor, which is a feature of these Scottish housing schemes, and furnished with wooden tables and forms. Kitchens and store-rooms adjoin each canteen. Each kitchen also serves as combined pantry and scullery and is fitted with a concrete floor and equipped with kitchen stove, sink and everything necessary for culinary purposes. At each canteen there is a staff of one cook and 4 helpers and a clerk in charge of tickets, etc. Both meals and dry goods (bread, etc.), are sold on the ticket system. No special arrangements for recreation are now in force at Auchterarder, but a doctor visits the estate on three days of the week and can be fetched at any time by telephone.

It is a striking fact that, at pre-war prices, practically the whole of the pickers' houses and their furnishings at Auchterarder seems to have been secured for the sum of £8,000—approximately £1,000 per centre. The settlement there certainly represents a landmark in the evolution of housing schemes for casual labour. The system of decentralisation, whereby the inhabitants are distributed into 8 camps, each complete, self-contained and under superintendence of a special official, marks a noteworthy advance and has gone far to solve the problem of dealing with diverse classes of seasonal workers.

Difficulty has been experienced from the beginning in obtaining a sufficient supply of suitable harvest labour. Industrial school children are extensively employed, but at present the bulk of the labour is apparently casual women workers from the towns. It will never be easy to secure adequate supplies of labour, owing to the difficulty of securing fruit-growing land near the towns and the fact that in fruit growing, as practised in Scotland, there is little diversity and hence the season is very short.

These considerations have evidently influenced the development of the housing schemes which have been outlined in this article. Scottish growers have been led to take a comprehensive view of the problem. In this respect, the co-operative character of such enterprises as Essendy has no doubt contributed largely to a satisfactory solution. It is a fair assumption, having regard to that flair for practical affairs, traditionally ascribed to Scotland, that the Scottish grower's provision for his workpeople is not philanthropy but a sound business proposition. It is recognised that suitable provision must be made if workers of decent type are to be attracted and retained, and if proper control is to be exercised while they are in residence. The erection of housing accommodation is regarded as an essential part of capital outlay. The latest Scottish camps for pickers are expressions of a wise policy, designed to secure true economy, and it is greatly to be hoped that standards in this country may approximate more and more to those attained at Auchterarder.

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THE CO-OPERATIVE MARKETING OF EGGS.

Major H. D. Day,

Chairman, Stamford and District Co-operative Egg and Poultry Society, Ltd.

As one of those who gave evidence before the Linlithgow Committee, the writer feels that the following account of the working and organisation of a small co-operative distributing society dealing solely with eggs may be of interest.*

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* *See also* "A Successful Egg and Poultry Co-operative Society," this *Journal*, May, 1922, p. 171.

The standard of egg sold off the general farm is not by any means good, and this is abundantly proved by the fact that last year the Stamford Society removed 2,821 *bad eggs* from those collected. One of the principal objects of a co-operative egg-collecting society is the elimination of all eggs not up to standard from those sold as best English new laid. How this is effected by such a society when properly run is described below.

Method of Working.—The society described is the Stamford and District Co-operative Egg and Poultry Society, Ltd., and is affiliated to the Agricultural Organisation Society. Its Headquarters are a shop and premises in High Street, Stamford, and the district from which eggs are collected is roughly a radius of nine miles from this centre.

The collecting area is divided into five journeys, which are worked as follows:—Monday, 2 journeys; Tuesday, 2 journeys; Wednesday, 1 journey. All eggs are taken to the centre, where they are sorted, tested and repacked for delivery on Thursday and Friday, leaving the vans idle on Saturday for cleaning and overhaul.

The eggs collected are mainly paid for in cash by the collector who enters the transaction in a counterfoil book which both he and the member sign. thus making a receipt both ways. The original is held by the member and the carbon copy kept by the society. A few of the larger producers prefer a monthly payment, and their accounts are paid monthly by cheque on the first Friday in the month.

On arrival at the depot the eggs are unpacked, and all dirty, undersized and duck eggs are sorted out from the bulk of first-quality eggs. They are then candled, and all stale. cracked or otherwise imperfect eggs eliminated. As perhaps the candling of eggs, though one of the simplest processes in the world, is not known to all it may be mentioned that it merely consists of holding the egg before an aperture—of about the same size as the egg—through which a bright light shines into a darkened room. The degree of transparence decides the freshness of the egg. and cracks or blood spots are easily seen.

After this sorting and testing, the eggs are sold by the manager. mainly to the retail shops in Nottingham, though about 3,000 to 5,000 per week are retailed over the counter in the shop in Stamford. These sales are as far as possible arranged on the Saturday, for delivery on the Thursday and Friday following Being thus arranged before the eggs are collected, the fixing of the price to be paid to the producer becomes a simple matter. Delivery of the eggs is made by the same vans which do the collecting earlier in the week.

The use of motor transport has the following advantages.—

(1) The Society's own man sees the buyer, often collects the actual cash and brings back empty cases;

(2) It does not matter how small a consignment is left at any one shop, and many of the smaller shops pay the better price;

(3) The manager is in close touch with customers, as he can often go over on the van with the eggs;

(4) The careful packing required when eggs are sent by rail is avoided;

(5) By avoiding transhipment the cases last much longer;

(6) Motor transport is much more economical and speedy than the railway.

History.—The Society was formed in September, 1916, as the outcome of the collection of eggs for the military hospitals. It started business with the assistance of the Agricultural Organisation Society in quite a small way, collecting eggs with a pony and trap.

The first motor van was purchased in the third year and the second in the fifth year (1920), and both these are now fully employed. The following table shows the position of the Society as shown on its annual balance sheets for the seven years of its existence. The profits shown are gross :—

Year.	*Capital*			*Turnover* (approx.)	*Profit.* (gross)		
	£	s.	d	£	£	s	d.
1916–17	132	12	6	3 750	216	17	3
1917–18	281	10	0	9,200	488	4	2
1918–19	352	12	6	12,250	285	6	8½
1919–20	382	10	0	16,500	131	12	11½
1920–21	444	10	0	16,350	42	13	11
1921–22	459	12	6	10,150	— 2	9	5½
1922–23	413	15	0	9,680	198	14	11

Unfortunately, the turnover in eggs for each year cannot be given, but for the past 3 years it has been approximately: 1 225,000 eggs in 1920-21, 1,080,000 eggs in 1921-22, and 1,257,000 in 1922-23.

This shows how the value of the egg has fallen since 1921 as, though the collections for that year were less than 1923 yet the actual value was much higher

The position as disclosed by the balance sheet for 1922-23 is very sound, as the *cash* assets of the Society at the end of the financial year (6th September, 1923) were more than sufficient to cover the capital and other liabilities.

Seasonal Fluctuations.—Though the number of eggs dealt with varies greatly from month to month (the maximum for the past financial year being 43,800 eggs in the last week of March, 1923, and the minimum 8,550 eggs in the middle week of November, 1922) it is noticeable that the average value of the weekly collection only varied during the same period from a maximum of £240 in February, 1923, to £170 in July of the same year.

Eggs Collected and Prices Paid in 1922-23.

Month.	*Average Weekly Collection.*	*Average Price per doz.* s.	d.	*Average Value of Weekly Collection.* £
September, 1922	17,750	2	2	200
October "	12,750	2	9	175
November "	10,300	3	6	180
December "	15,900	2	8	215
January, 1923	19,750	2	3	220
February "	29,200	1	8	240
March "	33,500	1	3	210
April "	35,000	1	0	175
May "	37,300	1	1	200
June "	34,150	1	2	200
July "	27,100	1	3	170
August "	20,800	1	9	175
Average per week for the year	24,450	1	7¼	£197 10 0

The price given here is that actually paid to the producer, and it should be noted that this includes all eggs bought, covering all bad, cracked and small eggs. The actual price received by the society was 22.15d. per doz. and a bonus of 3d. in the pound was paid to members.

Organisation.—The staff consists of a manager, a collector and the collector's wife. The manager is controlled by a Committee of Management which meets regularly on the first Friday in each month, and two members of the Committee are detailed at such meetings to attend on the intervening Fridays to sign cheques and settle any general business the manager may bring before them.

The manager is also the secretary, and his duties mainly consist in marketing the eggs collected and keeping the books. He also works a collecting round on Monday and Tuesday. His salary is augmented by a bonus on eggs collected and a share in profits.

The collector's duty is to collect eggs on three days of the week and deliver them on other days; he also helps with testing and packing, etc., when at headquarters. His wife runs the retail shop and does the bulk of the testing. Both of them share in any bonus.

Transport.—The transport consists of two covered Ford vans (*i.e.*, one small one and one one-ton truck). During the past year the vans have been run and kept in repair on contract by a local garage, and this has been found satisfactory. The driver being only paid for the days worked, one or two vans are used at a time as required, without the expense of keeping two permanent drivers.

Book-keeping.—The books used by this society are cash book, ledger, and two day books (one for eggs bought and one for eggs sold) and the Committee's report book. This latter is drawn up as follows and inspected weekly by the Committee:—

	Purchases.				*Sales.*	
Particulars.	*Eggs.*	*Value.* £	*Particulars*		*Eggs.*	*Value.* £
Forward from past week	87,000	620	Forward from past week		88,000	720
Bought during week ...	20,000	160	Sold during week ..		18,000	190
Expenses to date £25 per week for 5 weeks .	—	125	—		—	—
Total	107,000	905			106,000	910
			Stock in hand ...		800	
			Written off bad to date	160		
			,, ,, ,, for week	40	200	
Total bought—107,000			Disposed of ...		107,000	

Bank balance—£320 Debts owing to Society £185

This shows the Committee exactly how things stand at the date of the meeting, and enables them to see at a glance the data required when fixing the buying price for the ensuing week.

Finance.—As regards the cost of running a society of this sort the first consideration is the capital outlay. For plant, etc., £450 should be sufficient, the principal items being two Ford vans, egg boxes (we use almost entirely second-hand colonial egg boxes, 360 size), cash register, books and office furniture. The working capital, *i.e.*, the price of two or three weeks' collection of eggs, should be obtainable on loan.

The actual running cost of this Society last year was £1,145, with the turnover of 1,257,000 eggs. This is a cost of 2.62d. per dozen eggs for collection, testing and transport to the actual retailer Interest on capital, depreciation and bonuses to staff cost a further 0.46d. per dozen, depreciation being high as it is necessary to write off a large amount from the cost of the vans, which were bought originally at very high prices during the War.

General.—Co-operative depots ensure the marketing of high standard British eggs, as small eggs, etc., are graded out and sold as such. Last year 2,800 odd eggs out of a total of 1,257,000 (approximately 0.02 per cent.) were graded out as bad and destroyed. The depots save the producer all expenditure on cases, transport charges, etc., as the eggs are collected from his door, and as they are sold direct to the shops, middlemen, except the actual retailer, are cut out. They require certain geographical conditions for success. If tried in areas close to good markets, where they are in fact unnecessary, the producers can usually get a better price by taking their produce themselves to shops.

Good markets should, however, be within motor reach, as this saves much extra expense in special packing for railway transport, while the motors also collect and bring back the empty boxes, so effecting a further saving.

A certain minimum and maximum number of eggs is also essential. For a depot of the size here dealt with, a minimum of a million and a maximum of a million and a half is necessary. A smaller number would mean higher marketing charges per dozen, and a greater number a larger staff and more transport, with the same result—unless the number were very much greater, in which case a second society might possibly be the best course.

If more societies are formed near the same markets, co-ordination of marketing by them should be organised, for their mutual benefit.

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THE STOAT.

H. MORTIMER BATTEN, F.Z.S.

NATURE works in mysterious ways with regard to the stoat. No creature can be more timid and fearful of man, yet the stoat which streaks off at one's approach, gibbering terror, is as likely as not to turn like a rattlesnake and threaten unprovoked attack. One strange fact concerning this beast, which we regard as belonging essentially to our woods and hedgerows, is its occasional partiality to suburban gardens and even town dwellings, where cats parade at night time, and where the tread of human feet and the rumble of wheels are not the least disquieting sounds by day.

A stoat has been known to take up residence in a greenhouse or potting shed or similar outbuilding, where, becoming acquainted with the sight of human beings, it soon acquired indifference towards their presence.

I have from time to time received various records of this kind, but my own experience of the wild stoat is that it will readily forsake its chosen quarters if the presence of man becomes too frequent. This one quickly learns when attempting to photograph it.

Distribution.—It is frequently said that stoats are entirely nomadic in their habits—that except when they have young to feed they are resident nowhere. This is not always the case. Certainly stoats come and go, and the covert which is to-day free of them may a fortnight hence be over-run. In my own locality, for example, there were no stoats at all so far as one could judge last April. An epidemic of distemper had cleared them out, but it was thought by the keepers that they would reappear when the young pheasants began to run. They did not reappear, however, till the end of June, and by the beginning of August they were as plentiful as ever.

So far as one can determine a family of stoats reared, let us say, in a certain wood will continue to hunt that wood till full grown, that is, till the end of August or into September. They may be seen at the same places day after day hunting or chasing each other, but with the first autumn gales a new restlessness comes upon them, and they disappear.

This seasonal restlessness among stoats, which begins with the first fall of the leaves and lasts a fortnight or so, has often attracted notice. The madness of the March hare is proverbial, but no March hare is madder than an early autumn stoat. With the hare, however, the phrase is understandable, as March is their mating season, but with stoats the sexual instinct is more or less dormant in autumn. Yet during a windy day, when the first leaves were whirling about the hedge bottoms and the woodland corners, I have seen more stoats in a forenoon's ramble than one is likely to see during the course of any other month—crossing and re-crossing the roads more or less heedless of traffic, and bounding fearlessly about the leafy banks, where their quick movements are easily passed for a drifting leaf.

At first glance this characteristic would seem to indicate migratory instincts, which would appear to have some bearing on the distribution of the species. It has already been said that the young haunt their home quarters till wild weather begins, when, in view of the lean months ahead, the instinct comes to them to find other quarters. So the first storm winds bring about an immense shuffling and re-sorting among the beasts which, all summer, have come little before our notice, owing to the sheltered and shut-in lives they have led. Some of the families, to be sure, remain united into the winter, and family may join family till a pack is formed, but normally the families break up in early autumn.

But what about the new stock of stoats which turned up in my own locality during the month of July? To advance a theory would perhaps be rash, but I examined seven of these new-comers, everyone of which was an old dog—from which significant fact one is at liberty to draw one's own conclusions.

Summing up, then, I concluded that the mother and young haunt the vicinity of the nest till September or October. The male may or may not remain with his mate. In the majority of cases he does not, but lives a nomadic life the year round, and he is one of a great army of old males who, having been unable to hold their own against their own sex (or the opposite) have no family ties at all. The young begin to wander in autumn. Some of them become anchored by exceptionally good hunting, but the majority remain nomadic till they in turn have family ties. So we have at all seasons an immense number of nomadic stoats, in addition to those which, during spring and summer, escape notice by the retired lives they lead.

A Stoat's Larder.—At one time I had under close observation one of the many abandoned lead mines in the West Riding of Yorkshire, which were shut down thirty years or so ago. This particular mine is situated in the wild stretch of moorland country between Grassington and the valley of the Nidd, and wild life of all kinds finds sanctuary in the underground culverts and the immense masses of crumbling masonry.

One evening I saw a stoat run out of the furnace house with a frog in its mouth, and in the centre of the heavily paved washing floor it sat bolt upright, cutting a grotesque little figure as its elongated shadow fell across the flags. For fully a minute it sat without twitching a muscle, then with that spontaneous action peculiar to the weasel family, it dived through a chink in the flag on which it had sat. After a minute or so it reappeared from the same chink but without the frog, and having surveyed the landscape it darted off into the gathering gloom.

Thinking that the animal had its family under the flag, I went to some pains in rooting it up, and though there were no young stoats, my efforts were rewarded by the discovery of a genuine example of a stoat's larder. The frog most recently deposited was there alive, though it appeared to be paralysed by the scarcely discernible bite at the back of the head. There was half a grouse egg which had lain exposed to more than one hill storm, since the colour was washed from its surface; a great deal of sheep's wool—probably bedding—a kippered worm, which must have been a veritable boa-constrictor in its best days, and a good deal of rabbit and mouse remains. There may have been other oddments, but I have forgotten. Evidently the larder was used as a dining-room and occasionally as a bed-chamber, for there was no real stock of food.

I believe that every stoat which has an established hunting range has several such caches, to which it drags food when in the mood; but a nomadic stoat eats where it kills and sleeps when fed. Thus this animal has been found asleep in the nesting-box of the hen-house he had recently invaded, surrounded on every side by the evidence of his crime.

Voice.—Probably very few observers have heard the " bark " of a stoat, but it is a sound which, once heard, is not forgotten. One night I took one of these animals in a box-trap set in the garden at no great distance from my bedroom window, and during the night the stoat, while attempting to escape from the wire portion of the trap, was struck at by an owl. Thus I was wakened by a veritable pandemonium. Inside the trap, the stoat was barking repeatedly, while on a post near by the owl hooted and screeched. Clearly deadly foes had met, and each was much enraged.

The bark is almost identical to the sound caused by beating two flints together, and it is sufficiently powerful to carry two or three hundred yards. In this case the stoat kept it up for thirty minutes or more after the owl had left, and so haunting and malicious was the sound that it rang in my ears for some time.

Ferocity.—Stoats will attack practically anything they can catch and hold, and within my experience a pack of them attacked a lesser black-backed gull, which is certainly a formidable bird. The gull was roosting on a mound in the centre of a peat hag, and many other gulls occupied the swamp. The big gull was seen to rise, struggling desperately to obtain command of the air. Flapping and screaming it made its way across the swamp, where it fell into the rushes, and when the observer got to the place he found the bird almost dead, and saw several stoats run off through the rushes. This occurred in the West Riding.

Other cases are on record of stoats having been attacked by hawks, resulting in the death of both of them, or at any rate of the hawk.

Musk Glands.—In all the weasels, excepting the marten, the musk glands are highly developed. In the case of the badger, the secretion is not so nauseous as in the other weasels, nor is it used for the same purposes. It has, indeed, been said that the glands are provided in the case of the badger as a subsidiary means of tiding over the foodless months, but if this be so, their use is unique.

The value of musk glands, it is generally admitted, is to afford a means of bringing the sexes together, and doubtless they are there for this purpose in the case of the weasels. So highly developed are they in certain instances, however, that Nature seems to have run riot with her original scheme. Thus the skunk possesses the power of ejecting the musk in a fine choking spray which no beast will face, and there can be little doubt that stoats, weasels and polecats also possess this power to a much less degree. With them it merely amounts to being able to control the amount of scent they give.

Do stoats and weasels use their musk scent in their hunting? The available evidence would seem to prove that they do. It is known that a hare will run for miles from a marten, which is a practically scentless member of the weasel family, but how far will a hare or a rabbit run from a stoat? Not more than a mile or so at the most, for once that deadly taint reaches him he becomes paralysed with terror.

One day when motoring from Peebles to Edinburgh and when near to Leadburn I saw a rabbit cross the road and take shelter in some whins, while its manner of progress clearly indicated that it was being run by a weasel. I stopped the car to watch proceedings, and five minutes later a stoat appeared, running the trail of the rabbit. He saw the car and its occupants, and hesitated in crossing the road. With characteristic curiosity he came up towards us to investigate, and on his reaching a certain point the wind bore in a direct line from him to the rabbit, and at that precise moment a pitiful squealing was heard from the whins. This seemed to excite the stoat, and returning to his original line he crossed the road and went straight over to the gorse bush, whereupon the squealing ceased. Going up, I found the dead rabbit. In this case, as in others which could be recorded, the quarry gave up immediately it obtained the deadly musk scent of its pursuer.

For all their extraordinary abilities, stoats, like most beasts which are short in the leg and whose horizon, therefore, is limited, are possessed of very poor eyesight. They fear the

FIG. 1.—Stoat taking up a Bait.

scent of man greatly, but if they cannot scent him and can merely see him, they will watch curiously till within a few feet. This is a point to bear in mind when the stoat is seen at a distance, for by making use of the wind one can generally approach sufficiently closely for shot and powder to be effective.

Hunting in Trees.—Stoats are first-rate climbers, and where there are plenty of small birds and wood pigeons they habitually hunt ivy-covered trees. In Northamptonshire a partially devoured wood pigeon was found in an ivy tree, and a trap was set alongside it to discover the culprit. Next morning the trap was on the ground with a stoat fast in it.

Natural Enemies.—The stoat has no particular animal foes. Very few dogs, even, unless hardened hunters, will face this nauseous little musk bearer. More stoats are killed by stoats than by all the keeper's devices, and were this not so, game preservation would become difficult in many localities.

When stoat meets stoat it is either as mate or as deadly foe. In nine cases out of ten it is the latter. One turns and flees, and unless he or she makes good its escape, a fight to a finish is certain. They are the most deadly cannibals I know, and no bait is so irresistible to a stoat or a weasel as a member of its own race. Time and again I have known such a bait to produce results when all else had failed.

Trapping.—This brings us to the subject of trapping these bloodthirsty little beasts. In using steel traps a bait is not generally employed, as it attracts other creatures which will spring the trap and consume the bait.

Every keeper should have by him one or two good box-traps, and the accompanying sketches show the devices which the writer has found most convenient and effective. While at it, a thoroughly good article should be made, as shoddy workmanship only leads to unreliability, whereas a well-made box-trap will last a lifetime.

Fig. 2 is a double-ended trap, and is useful during the running season, as when one stoat is caught a second is almost sure to go to it and will thus be found in the adjoining compartment. Fig. 3 shows the best all-round trap for general use. As will be seen it consists of a tunnel, having a trap door at either end. On the spring plate being depressed, the doors close simultaneously, for it will be seen that any pressure applied to the spring-plate tends to move the crank controlling the doors over the dead centre position, in which it is poised when the trap is set. The bait is suspended from the lid of the trap directly above the spring-plate, and the stoat, endeavouring to tear it down, is bound to spring the device. One of these

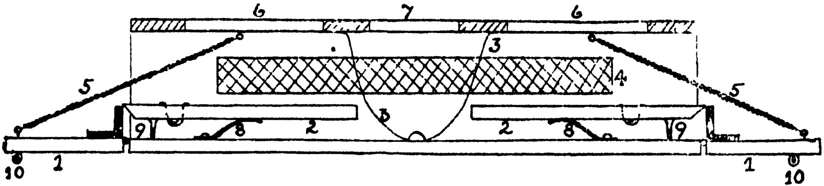

Fig. 2.—Double Ended Trap (Longitudinal Section).

1. Trap Doors.
2. Spring Plates.
3. Wire Netting Tray in which Bait rests.
4. Wire Netting Windows (both sides).
5. Door Springs.
6. Lids to separate ends.
7. Lid for renewing Bait without disturbing trap.
8. Light Clock Springs to return Spring Plates.
9. Screws fixed in floor to serve as stops for Spring Plates.
10. Leather Tags for opening doors. To set Trap the doors are simply opened, whereupon the spring plates automatically engage with the triggers.

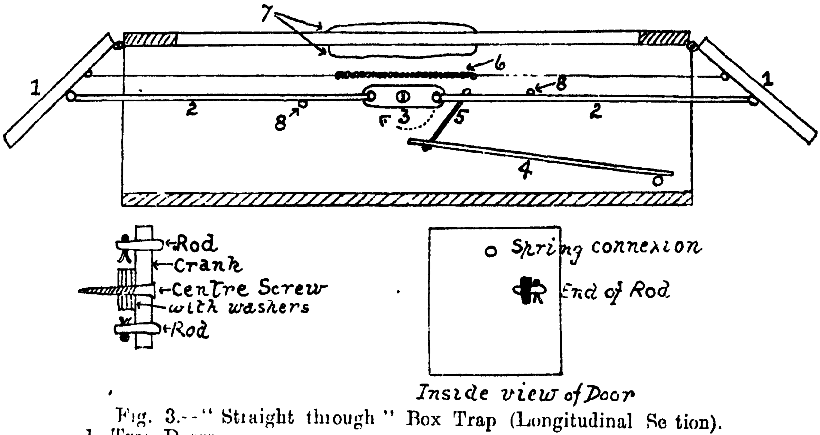

Fig. 3.—"Straight through" Box Trap (Longitudinal Section).

1. Trap Doors.
2. Thick Wire Rods which actuate doors.
3. Crank, free to rotate on its centre screw. As shown it is at dead centre, and both doors are propped open. As the crank turns in direction of arrow both doors close.
4. Spring Plate.
5. Cord connection between spring plate and crank.
6. Door Spring.
7. Strong Spring in lid for bait and handle.
8. Stops.

should be set along a wall bottom with iron traps on either side of it.

Mating.—Running begins in February, and the young, five or six in number, are born for the most part early in April. By the middle of that month the keeper should keep a close look-out for them, as even before their eyes are open the mother will often bring them out to bask in the sun. A little later they play about the den mouth, quite fearless of man, but if disturbed the dam will remove her litter quickly as a vixen, and they are then lost for all time. Thus, when following the dykes or woodland banks at this season, the keeper, or whoever it be, needs to keep very keenly alive, and to move as quietly as possible.

Stoats will breed anywhere that adequate shelter exits. I have known them to breed in stone walls, in ruined buildings, in upturned tree roots, and in rat burrows about the hedge bottoms. Generally the nest is built of leaves, and sometimes of grass. When running, stoats follow stone walls for preference, showing a special partiality to certain walls which become known to the keeper as time passes. The animals are still comparatively rare in my own locality, but there is one ancient wall which runs for miles across country where they can be trapped with some regularity.

Colour Change and Value of Tail.—The *sine quâ non* of the stoat is, of course, his black tipped tail, which follows him everywhere like an angry hornet. Almost as often as not the black tip is what catches the eye.

The tail of the stoat bears evidence to an ancestry more arboreal in habits than were the ancestors of the weasel and the otter. Evidently this animal springs from the same line as the martens, and its comparatively bushy tail has its distinct uses. The tail of the squirrel is his rudder, his parachute. It assists his leap, it breaks his fall, it enables him to land head upwards on the vertical trunk. So anyone who has seen stoats hunting each other will have observed the important part the tail plays. Bushed out like a bottle brush, it is whirled this way and that with every lightning double and twist, and it is suggested that a wild stoat deprived of its tail would not long be able to exist. It would disappear, just as certainly as does the squirrel on which such a mishap falls.

Stoats begin to assume their winter coat in November, and the change back occurs during February and March. A great deal depends upon the altitude and the climate of the range they haunt. Those which inhabit high country are usually quite white by December, and may remain so till the middle of March, whereas a stoat living in the low country may merely become camouflaged with white, as though with pardonable uncertainty as to what the weather gods will send.

Indeed the colour change of the stoat presents one of the curiosities of nature, and at the time of writing zoologists are at work in the hope of throwing new light on the subject.

THE IMPORTANCE AND VALUE OF POULTRY FEATHERS.

Communicated by the Rural Industries Intelligence Bureau.

POULTRY keeping, at one time little more than a sideline of merely secondary importance to the majority of those undertaking it, has of late years developed into a highly organised and scientifically conducted rural industry, on which an increasing number of people tend to rely for a partial, indeed, in many cases, for a principal means of support. A particular feature since the War has been the large number of ex-Service men who have taken it up for a living, in most cases on a small scale.

There is no intention in these brief notes of dealing in any way with the technicalities of poultry husbandry. This subject is outside the scope of the Bureau's activities, and is amply catered for by many competent and valuable organisations, periodicals and text books. Nevertheless, poultry keeping is not so remunerative that those engaged in it can afford to neglect possibilities, however small, of adding to its earning capacity, and this is especially true when the occupation is carried on in a comparatively small way.

Various indications suggest that quite a considerable proportion of poultry keepers overlook the fact that the feathers of their birds are a marketable .commodity, and though business practice may often entail sending away living or unplucked birds, feathers which might be collected and disposed of are, in a very large number of cases, treated as valueless rubbish.

Imports.—The following figures will give some idea of the quantities of feathers that are annually imported into the United Kingdom from abroad :—

	1913.		1920.		1922.	
	Cwt.	Value	Cwt.	Value.	Cwt.	Value.
		£		£		£
France	3 778	11,108	2.239	21,100	3,260	12.250
Germany .	3 553	35,715	507	14,975	435	1 577
Netherlands .	45	297	4,989	28,308	86	586
Denmark		—	—	- -	4,491	31.479
China	9,989	33 923	27.367	223.692	18,292	79,876
Hongkong	18,616	55,669	36,55	245.309	21,467	87.841
Japan ...	3 330	3,867	37	329	636	1,349
U.S.A. .	3 329	6,515	5 311	22.077	12,825	21.264
Other countries	2 376	12,272	2,114	31,726	4,612	29,543
TOTALS	45,016	£159,366	79,115	£587,516	66,104	£268,765

For purposes of comparison the following totals for intermediate years are added:—

1919—52,468 cwt. valued at £284,791.
1921—27,894 cwt. ,, ,, £146,644.

It will be evident that after a heavy drop in 1921 from the high figures and prices of 1920 the demand for this commodity is again very decidedly on the increase.

Besides imports from foreign countries into Great Britain, considerable supplies come from Ireland to Great Britain, as the following figures will show:—

1913—20,324 cwt. valued at £42,680.
1920—15,557 cwt. ,, ,, £72,599.

All the above figures relate to imports of the cheaper sorts of feathers (described as "in or for beds"), *i.e.*, poultry and the like, and do not include the rarer and more valuable kinds such as are used for expensive millinery and other ornamental purposes.

It is hoped by these extracts from official sources to bring prominently to the notice of those interested in poultry keeping in this country, the fact that poultry feathers are the raw material of quite a considerable industry, for which by far the greater proportion of the present supplies is now obtained abroad. There can be no doubt therefore that the collection of these feathers is well worth the attention of the poultry keeper at home.

Grading.—Poultry feathers should be graded as follows:—1. Down feathers; 2. Soft feathers; and 3. Stiff wing and tail feathers, usually referred to generally as quill feathers. In addition, white feathers, which are more valuable, should be kept separate from coloured ones.

Uses.—Down feathers are used chiefly for stuffing mattresses, pillows, cushions, etc. Soft feathers are also in many cases used for similar purposes, but they have a further use in the millinery trade, and by no means only for the least expensive class of goods. White feathers command the highest price for these purposes. It is generally considered that imported feathers are better than English ones and they have in the past realised better prices, but the main reason for this preference appears to be that they are more carefully graded and prepared to suit the feather merchant's requirements.

Quill feathers are of less value and use now-a-days than either of the other kinds. Not all dealers will accept them, but they are nevertheless used for a number of purposes, amongst which may be mentioned the manufacture of feather dusters and certain other articles in the fancy goods and artificial flower trades, a certain amount of oats was grown, but the main crop relied upon was barley, utilised for bread-making for home consumption. Late potatoes were produced and those surplus to domestic requirements were exported to France and Portugal. Early sorts were not cultivated in those lean farming days when the inhabitants of the islands lived a hand-to-mouth existence and the potentialities of the soil and climatic conditions had not been discovered. It is probable that fishing was more extensively engaged in then than at the present time. The bulk of the fish was marketed in Brest.

The Birth of the Flower Industry.—Forty-three years have elapsed since the first steps were taken towards the establishment of the flower industry, and it is highly improbable that its pioneers foresaw that it would reach its present dimensions. A few Soliel d'or, Scilly White. and possibly some Double White Narcissi, growing in the islands, and till then practically ignored, were planted out and cultivated for the production of blooms for market. It is believed that these were disposed of in Penzance, and good prices were realised for the magnificent flowers produced. This humble beginning in the cultivation of a few narcissi opened up the prospect of a way out of the poverty which the islanders had for so long endured. The next step seems to have been the introduction of *Ornatus* from the districts around Paris. Then came *Princeps*, *Obvallaris*, *Henry Irving*, and, in due course, other varieties which are still known and welcomed in the English markets. Little by little the advantages of the equable climate and warm soils were disclosed, until to-day flower growing is the staple industry—in fact, it would appear, that upon the continued success of this industry depends the future prosperity of the Scillies. Doubtless there are side-lines which may come in very usefully, such as early potatoes, which have been profitably exploited, asparagus and other items yet to be determined, but it is difficult to predict any crop that will displace the cultivation of flowers as the main source of revenue. Assuredly, plants other than bulbs will play their part in a well conceived rotation, but always as a preparatory crop for the betterment of the soil conditions in view of the production of flowers for the early mrakets.

The Present Difficulties of the Flower Industry.—During the past few years increasing difficulty has been experienced in procuring good crops of flowers. Recent investigations made in the islands point to the probability of a number of factors contributing to the conditions responsible for the declining yield. Some of the soil is undoubtedly sour and unbalanced, owing to the indiscriminate use of artificial fertilisers, the inadequate use of lime, and constant cropping with narcissi. Eelworms have been found to attack bulbs; bacteria and fungi are also present. It is not to be inferred that the islands are full of disease and that the flower industry is on the verge of disaster. Far from it! But the state of the soil and the introduction of the pathogenic organisms referred to above are sufficient to arouse apprehension as to the future. The inhabitants of the Scillies have initiated and built up an industry, and the same persistency and determination to succeed that have characterised them in their years of effort, are evidencing themselves now in order that the hard-won position may be consolidated and maintained. The combination of circumstances that has arisen to hinder them in their march to prosperity has no doubt influenced them in their decision to avail themselves of the opportunity of setting up a system of Horticultural Education which has presented itself through the action of the Duchy of Cornwall and the Ministry of Agriculture.

System of Horticultural Education.—The Council of the Isles of Scilly is responsible for education in the islands. There are five schools, one on each of the inhabited isles. The schools are maintained out of local rates, a grant in aid of approved expenditure being paid by the Board of Education as in the case of such expenditure incurred by Local Authorities on the mainland. The Council has now transferred its powers with regard to agricultural education to the Agricultural Committee, and a grant in aid of approved expenditure under this head will be paid by the Ministry. The Duchy of Cornwall is making a special contribution to the rates for the purpose of the scheme.

The Agricultural Committee has appointed an advisory research worker, who will reside on the Island of St. Mary's, and act as technical adviser to the Committee. He will also give lectures and pay advisory visits to growers on each of the islands.

Proposed Experimental Station.—Some ten acres of land have been put at the disposal of the Committee, by the Duchy of Cornwall, for the purpose of establishing an experimental station. All problems relating to bulbs will be dealt with here. Manurial and variety trials for bulbs and early potatoes will be undertaken, and new sorts tested. Other crops likely to prove useful in balancing the rotation and for early market work will be grown. This new departure will be watched with interest. It is the only experimental station specially interested in bulbs in Great Britain, and possibly in the world.

The Control of Plant Diseases.—Another innovation in the islands is the erection of a bulb sterilising plant. The Duchy of Cornwall has had this plant installed for the use of growers and it will be run, as far as possible, on a self-supporting basis. Those wishing to have their bulbs sterilised will be able to do so upon payment of a small fee, thus relieving them of the necessity of making a capital outlay for the purchase of their own sterilising plant. The proposal is to have an experienced man in charge of the plant, who will also be attached to the experimental station and be able to fill in his spare time at the farm.

By request of the growers, the Ministry has issued an Order, entitled " Bulb Diseases (Isles of Scilly) Order, 1923," which came into operation on 1st January, 1924. The provisions of the Order are designed, *inter alia* (*a*) to impose restrictions on the importation into the islands of daffodil and narcissus bulbs; (*b*) to procure the destruction or treatment of diseased bulbs which may be present within the islands.

The Future of the Flower Industry.—The islanders are to be congratulated on the enterprising methods which they are entertaining for the preservation and development of their industry. They are gradually adopting more modern ways of packing and marketing their produce.

They have two Growers' Associations, one on St. Mary's and one on Tresco, which witness to their belief in co-operation. It is to be hoped that co-operative methods will be developed and the logical conclusion reached in the amalgamation of the associations now in being. In the recognition of such potent factors as co-operation and education in the development of an industry, their business acumen is disclosed. When the application of the results of scientific research displaces where necessary old practices based upon past precepts, there should be no misgivings regarding the prosperity of the flower industry of the Isles of Scilly.

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WOODLICE IN GLASSHOUSES.

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THE woodlice inhabiting glasshouses are limited to a few species, some of which, however, occur in enormous numbers.

As one would expect, some are found commonly in the neighbourhood of glasshouses, and enter during the winter months to obtain shelter. Others seem especially adapted to life at high temperatures such as obtain in cucumber houses during the summer, and seldom, if ever, occur far from the houses, though they are capable of withstanding severe frosts outside, provided that they can bury themselves to some depth in heaps of soil. The general food of woodlice consists of decaying or fermenting cellulose, but they will, under certain circumstances, gnaw the stems and roots of healthy plants, and some even climb to eat pear-shaped holes in the leaves.

Certain species of the genus *Armadillidium* cause very serious damage to growing plants. *Armadillidium speyeri*, Jackson, and *A. pictum*, Br., are practically confined to cucumber houses, the former being exceptionally abundant and voracious. *A. vulgare*, Latr., the common pill woodlouse, is found more often in the cooler tomato houses, is very numerous in peach houses, and is also found in the nests of ants. All these roll up into a ball when disturbed, a complete sphere being formed by the broad and bulky *A. vulgare*, while in the other two more slender and active species the tail appendages overlap the head. Two other species are common in tomato houses, namely, *Porcellio laevis*, Lat. and *Haplophthalmus danicus*, B. Lund, but they do little damage to the plants.

The breeding season for these woodlice occurs from early spring to August. The young escape from a specially developed pouch on the underside of the thorax in which the eggs develop.

Winter Habits.—On the approach of winter, *A. vulgare* buries itself to a great depth in the ground and there remains inactive. The species found in cucumber houses, however, remain more or less active, unless they are taken outside when the borders are cleared from the houses. In the latter event they will remain buried until spring, when they become active and readily regain access to the houses.

Damage to Plants.—The species of *Armadillidium* are brought into propagating houses in great numbers from heaps of soil which have been stacked outside during the winter. When the seedlings appear in the boxes, the hungry woodlice at once find a suitable supply of food. *A. speyeri* causes most loss by biting through the stems of tomato seedlings near the soil level, and *A. vulgare* is also responsible for similar damage, though to a less extent. At this time, the cucumber seedling is not so liable to attack. When the plants are potted out *A. vulgare* ceases its activities, but *A. speyeri* turns its attention to them.

Pear-shaped holes are eaten in the lower leaves, the cotyledons often being entirely destroyed, and in severe cases a considerable portion of the leaf-surface is removed. Such damage is continued throughout the growing season upon plants in the border unless control measures are employed.

Late in the season, *A. speyeri* has been observed to do considerable damage by eating the petals of carnation flowers. *A. vulgare*, on the other hand, is much less harmful and usually leaves tomato houses in May or June. As the cucumber borders are top dressed throughout the growing season from heaps of soil and manure outside, the number of woodlice increases to an enormous extent as the season advances. *A. vulgare* is particularly addicted to removing the bark from branches of peach-trees. Both species feed mostly at night.

Control Measures.—In glasshouses, control measures may be divided into two categories:—(1) Destruction of woodlice in the winter; (2) Trapping in summer.

(1) **Destruction of Woodlice in the Winter.**—At the end of the season when the border soil is removed from the cucumber houses, great numbers of woodlice are taken away at the same time. Those that remain may be destroyed by hot water or cresylic acid.

(a) *Hot Water Treatment.*—Where apparatus is available for the distribution of water at a high temperature in glasshouses, the treatment is undoubtedly the most radical in the control of woodlice. To determine the effect of temperature on these woodlice, a thermostatic bath was employed. In this was placed a vessel containing soil into which the woodlice could be introduced. With the water in the thermostat at 147° F., the soil at an internal temperature of 146° F., and with a surface temperature of 124° F., all woodlice introduced on the soil surface were killed in 30 seconds.

With the thermostat temperature at 140° F., the soil internally at 136° F., and the soil surface at 108° F., woodlice similarly introduced were killed within two minutes. Woodlice dipped for half a second in water at 149° F., died within a few minutes after immersion. These experiments show that the *Armadillidium* is easily killed by water at comparatively low temperatures and accounts for the efficiency of the hot-water treatment.

(b) *Cresylic Acid Treatment.*—If the necessary apparatus for hot-water treatment is not available, the woodlice may be

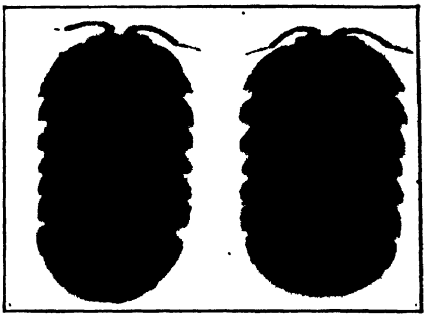

FIG. 1. The Pill Woodlouse (*Armadillidium vulgare*, Latreille) enlarged: (*left*) male: (*right*) female. Note the absence of the rostrum on the head, and the thick rounded appearance of the animal.

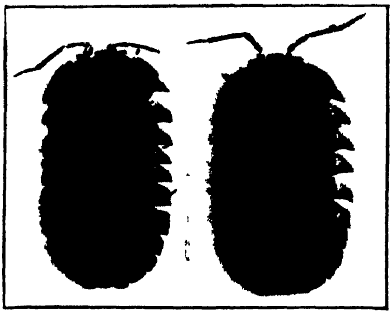

FIG. 2. The Cucumber-house Woodlouse (*A. speyeri*, Jackson) enlarged: (*left*) male; (*right*) female. Note the shape of the tail appendages and the very prominent rostrum on the head.

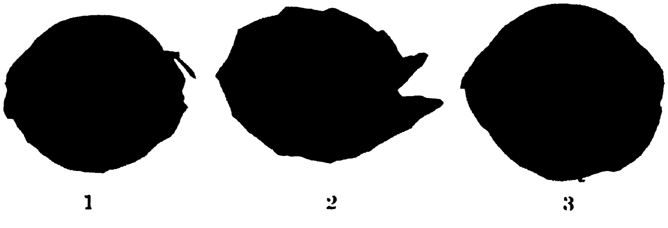

FIG. 3.—(1) *A. speyeri*, Jackson. Anterior view of animal rolled up.

(2) *A. speyeri*, Jackson. Side view.

(3) *A. vulgare*, Latreille. Anterior view of the animal almost rolled up.

Note the straight line formed by the edge of the posterior segments in No. 3, and the projection of the abdomen beyond the head in No. 2.

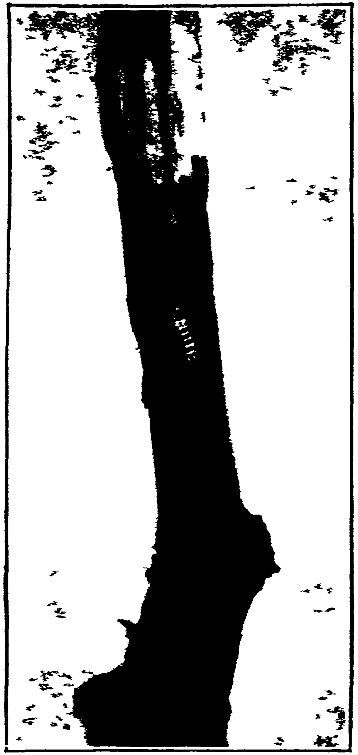

FIG 4 — *Armadillidium speyeri* Jackson damaging Cucumber stem

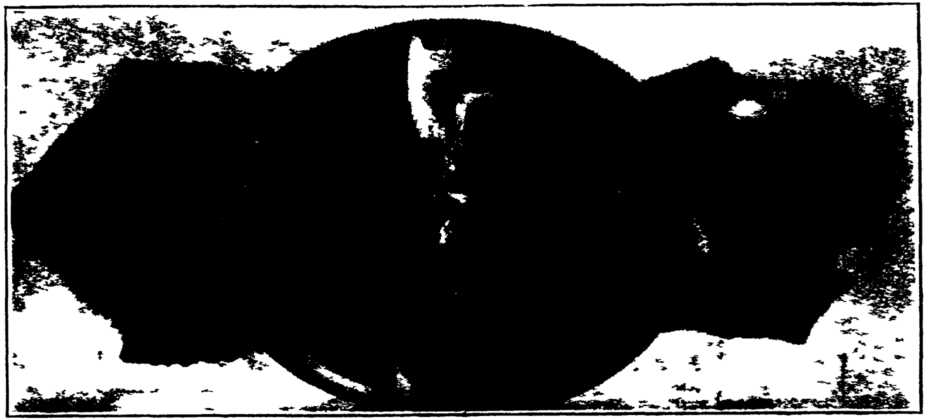

FIG 5 — Showing damage to Cucumber pot plant caused by *Armadillidium speyeri* Jackson

destroyed by spraying thoroughly the soil, walls, and woodwork with the following mixture :—

Cresylic acid (pale straw 97–99 per cent.) ...	1 gallon.
Potash soft soap (household)	8 lb.
Pure naphthalene	½ lb.

These are heated together in a bucket till the soap is melted and the naphthalene dissolved. For spraying, 2 pints of the mixture are used to every 12 gallons of water.

The following experiment serves to illustrate the effectiveness of this treatment. A cucumber house 15 ft. × 12½ ft. (1,000 cubic feet space) was treated exactly as described above in November, 1922. Two days after spraying a collection was made from one side of the house only, and the following figures show the relative proportions of living and dead woodlice :—

	Dead.	Living.
Armadillidium speyeri	481 ...	5
Armadillidium vulgare	98 ...	1
Metapornothus pruinosus	1 ...	6
Total	580	12

This represents a mortality of just under 99 per cent.; the efficiency of the mixture is due in part to the cresylic acid and in part to the naphthalene.

2. **Trapping in Summer.**—It has been remarked that these woodlice feed for the most part upon decaying cellulose, and that they obtain an ideal supply of food in the cucumber borders. This makes it a matter of great difficulty to attract them with any substance used commonly in baits. As an attracting basis coarsely ground oatmeal has been found more useful than bran, flour, or starch: it becomes specially attractive to the woodlice when mixed with glucose or treacle. Laevulose, saccharose, mannite, and glucose were tested; the last appeared to be most attractive. In our experiments, which were carried out with several arsenical compounds, we have stained the poisoned oatmeal with cochineal, and after several days have dissected the woodlice to make sure that they have eaten the bait, the red cochineal being readily detected in the stomach of the woodlouse. In not a single case has a woodlouse died from eating these poisons, although in all cases the bait has been found in the intestines of the animal when dissected.

After a number of unsuccessful trials with compounds containing copper, it was found that substances containing chromium had the desired effect, the soluble bichromates being the most satisfactory. Of the latter, potassium bichromate when used in a solution above 2½ per cent. strength caused death in every case. Solutions containing but a trace of potassium bichromate when injected into the bodies of woodlice have produced almost instant death.

A bait consisting of oatmeal 10 parts, glucose 2 parts, potassium bichromate 1 part, and water 10 parts, costing about 3d. per lb., which acted consistently on woodlice kept in jars and dishes, was only successful to a slight degree when used on cucumber borders, owing to the difficulty of attracting the animals from their natural food. It still remains, however, to give this bait a trial in the propagating houses, where it will be more useful, being distributed at times when the woodlice are short of food.

Pot-trapping.—The use of inverted flower-pots filled with straw has long been in vogue for catching woodlice. The following tables show the numbers caught with various materials in the pots :—

November, 1921. Average number caught in one pot per night on cucumber house subsoil.

Substance.	*Average number caught in one pot over four days.*
Common straw treated with boiling water	43
Border straw + dung, untreated	74
Ditto, treated with boiling water	104
Fermented straw	154
Common straw treated with boiling water + molasses	272

August, 1922. Actual numbers caught in one pot per night on cucumber border with growing plants.

Substance.	*Numbers caught in one pot.*				
	1st day.	2nd day.	3rd day.	7th day.	Total.
Common straw, untreated	2	2	0	3	7
Common straw, untreated + 5 per cent. glucose	5	7	2	8	22
Fermented straw ...	3	15	30	43	91
Fermented straw + boiling water	0	4	0	0	4
On another border ·					
Fermented straw ...	200	170	122	50	545
Fermented straw + 5 per cent. pot. bichromate ...	38	100	14	8	160
Fermented straw + 10 per cent. pot. bichromate ...	0	2	0	0	2
Fermented straw + 10 per cent. calcium bichromate	2	0	0	5	7
Common straw, untreated	530	32	0	14	576
Common straw + 10 per cent. glucose	2,500	200	12	0	2,712

These figures show that fermented straw is more attractive than unfermented, and that the addition of glucose to common straw increases its attractive qualities; that addition of potassium or calcium bichromate makes the straw distasteful; and that the attractive ingredients in fermented straw are soluble in water and can be extracted.

Further, it is seen that in a given area the number of woodlice decreases with consistent pot-trapping. Any method of this kind is, however, laborious on a large scale, and is only successful over limited areas.

Vegetable Baits.—By far the best control, both in cucumber and tomato houses, is attained by the use of red beets or mangolds. These are cut in halves and placed face downwards on the soil, one half to every four plants. The woodlice collect in large numbers on the vegetables, and are shaken every morning into a pail of hot water All the woodlice cannot be destroyed by this method, but they are kept from feeding on the plants. Red beets are preferable to mangolds as they decay less rapidly, the former lasting from six weeks to two months.

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DESTRUCTION OF WIREWORMS.

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The following figures are the result of a study of the numbers of wireworms in arable land made during the years 1914 to 1922 inclusive. Most of the figures refer to land ploughed up from pasture, and show the gradual reduction under cultivation of the huge numbers in the original pasture. No special treatment was given in any of the fields and no insecticidal dressing was added.

The method adopted in obtaining the figures was to dig out portions of soil in different parts of the various fields, carefully crumble and sift the samples, and count the wireworms in them. The size of the test samples of soil was at first one foot cube, but later blocks 9 in. square on the surface and 1 ft. in depth were used.

The number of test samples in a field varied from five to twelve, and in subsequent counts on the same field the same number of samples was taken. The average number of wireworms found in the samples from a field was then multiplied to obtain an estimate of the number per acre.

Permanent Grass Fields.—Samples were taken from eight pastures, varying in size from 3½ to 14 acres and in soil from light loam to heavy loam. The estimated number of wireworms per acre in the different fields was found to vary from 103,000 to 900,000. the average being 305,000. In four arable fields which had been over five years under cultivation the number varied from 44,000 per acre to 95,000 per acre, the average being 81.000.

It will be seen that the wireworms were approximately four times as numerous in the grass land as in the arable land. In general they were more abundant in the lighter soils.

Depth Distribution and Local Movement of Wireworms in the Soil.—Although no attempt was made to count the numbers at different depths the following observations were made. On grass land the wireworms were near the surface, the great bulk being in the mat of roots in the top inch of soil. Relatively few were below 3 in. and they were rarely found lower than 6 in.

There was no evidence of a downward movement during cold weather. The observations were made during the worst months of the year, and several times counts were made immediately after very severe frosts. On one occasion during 18 degrees (F.) of frost lumps were chopped out of the surface. The wireworms were embedded tightly in the frozen mass and were alive and unaffected after the subsequent thaw.

On arable land the wireworms appeared to avoid the dry loose surface and were found to be most numerous at 3 or 4 in. depth: they were frequently about 6 in. deep but very rarely below 9 in.

The crop grown on a field, however, exerts a considerable influence on their local movements. With cereals and " seeds " they remain fairly evenly distributed, but with more widely drilled crops they collect in quantity along the rows and are often closely massed together. White turnips appeared to collect them most, and from small root systems 30 wireworms were often gathered. Swedes, cabbages, kale, potatoes and mangolds were also good collectors, but not so good as turnips. Beans and peas did not appear to influence them much unless the beans were dibbled and the peas drilled thinly with wide intervals between the drills.

This local movement and its apparent variation with different crops appeared to be connected with:—

(*a*) Preference or otherwise for the crop as food;

(*b*) Relative spreading of the root systems of the plants, especially when these are young;

(*c*) The difference of cultural treatment, especially the more or less complete removal of weeds between the drills and the disturbance of the soil.

Migration *en bloc* from one portion of the field to another never took place. For example, turnips, oats and linseed in one field did not affect the average distribution. Frequently damage showed on one crop and not on another, but the general distribution was not altered, for example, potatoes showed damage on one half of a field and oats on the other apparently did not suffer. Oats suffered in another case whereas peas on the same field did not. Beans were apparently unaffected in another field while kales were taken.

Reduction under Cultivation.—The following table shows the reduction in the estimated numbers when grass land was ploughed up and kept under cultivation for a number of years:—

Field Q was ploughed up in 1914 (Autumn), and fields T, M, and 10 were ploughed up in 1918 (Spring). Field 3 was old arable land.

Field.	Estimated number of Wireworms per acre.								
	1914	1915	1916	1917	1918	1919	1920	1921	1922
Q		900,000	850,000	680,000	440,000	283,500	32.700	21,800	6,000
T	—	—		—	510,000	435,600	331,700	148.000	18,000
M	—	--	—	-	350,000	228,700	94,000	50.000	15,000
10	–	—	—	—	215.000	92.600	26,800	30,000	43.600
3	218,000	—	50,000	—	43.600	—	116,160	—	49,100

It will be seen that there was a continuous and rapid fall in the wireworm content, especially after the first year under cultivation.

From a study of the cropping of these fields the number 200,000 per acre may be considered the utmost limit for safety as regards damage to crops. From 100,000 to 200,000 will be tolerably safe for cereals, broadcast crops, established plants, or strong spreading rooted crops. Crops such as turnips or any late sown crops which occupy restricted portions of the field, and which are small during the summer months when the wireworms are feeding fast, may be damaged by this number. Below 100,000 wireworms per acre little damage need be feared and below 50,000 it is negligible.

Five years' cultivation appears to be sufficient to reduce the wireworms in ploughed up pastures to unobjectionable proportions. The reason for this will be plain when it is remembered that they live on an average through five winters. As they are not extensively parasitised at any particular stage, nor likely to be preyed upon at one stage more than another, it is safe to assume that in a field of ploughed up turf they will be present in varying ages from one to five years in approximately equal numbers.

Assuming this to be the case there would be one-fifth normally hatching out into adults each year. and unless eggs were laid the effect on the total would be a diminution of one-fifth, so that even in the most serious cases five years would eliminate them. From a study of these fields this seems to be actually the case and this hatching out of adults and prevention of egg laying is the greatest factor in eliminating wireworms under cultivation.

Under ordinary farm conditions it seems difficult to increase very materially the above rate of elimination. Such birds as rooks and lapwings undoubtedly help a good deal, and so do poultry run on the fields while tillage operations are being carried out, when the soil is loose and the wireworms exposed. Intensive cultivation also helps considerably and shortens the period for elimination of the wireworms. It should be possible under intensive cultivation to shorten the period to three years instead of five, even if the wireworm content be considerably above 500,000 per acre.

The writer has on two occasions reduced to a negligible quantity in one season wireworm contents of 850,000 and 800,000 per acre. By intensive cultivation is meant continuous cropping by hoed crops or frequent cultivation in the brief periods between successive crops

Cropping of Infested Fields.—A large number of different crops were planted in these fields during the years in question, and a careful record was kept of the effect of wireworms on each crop. The following is a summary of the observations made.

Of cereals oats proved easily the most satisfactory on wireworm-infested land. Where their number was large and there was consequently a considerable loss of plants the older varieties such as Sandy and Clemrothery gave better yields than the modern ones owing to their greater tillering power. Where, however, the loss of plants was not great the new varieties yielded better. although the crop looked much worse. Barley was the worst of the cereals for wireworm land and wheat intermediate. Rye was not tested sufficiently on these fields to enable one to form an opinion.

Beans are a tolerably safe crop where wireworms are numerous. The size of the whole root system compared with the spacing of the plants makes it unnecessary for the wireworms to move about much. The best crop in the district was harvested on a field with 116,000 wireworms per acre. The only failure of beans was after dibbling very thinly. This practice seems to be unwise on such land.

Peas are nearly as safe as beans on their particular soils, but only if broadcast. Thin drilling in rows is risky, especially when the rows are more than a foot apart. As a rule peas cropped well on the six occasions when they were planted in these fields under observation.

Potatoes usually grow well, but if the wireworms are too numerous there may be gaps due to destruction of seed tubers or sprouts. The soil on ploughed up land is usually sour and on such land the potatoes do well. The looseness produced by the buried turf also favours the crop so that good growth is obtained. A proportion of the crop is holed by the insects and may be spoiled for market. This proportion will necessarily vary with the number of wireworms in the soil.

Swedes, turnips and mangolds are liable to serious damage by wireworms, and such damage will be increased if the rooks discover the field and come after the insects. These crops are drilled at a time when the wireworms are particularly active and they cannot be left unthinned or bulb formation would be prevented. They are very unsatisfactory crops for infested land, and only a specially favourable season producing rapid growth can save them. Of the cabbage tribe kales are the best to grow on such land as they can be left unthinned and still produce abundant forage. The wireworms will do a considerable amount of thinning, in which case neighbouring plants partially fill out the gaps. A crop of cabbages planted on the field from good strong plants can also do well in spite of large numbers of wireworms in the soil, provided the plants be kept growing. Linseed was never damaged on these fields, and in every case yielded the maximum crop that the season and particular soil permitted.

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ANGORA RABBIT WOOL PRODUCTION:

A PROFITABLE SPARE-TIME OCCUPATION.

W. WATMOUGH.

THE production of Angora rabbit wool has opened a new field to the utility rabbit breeder. This wool is so much in demand by spinners at the present time that 30s. to 40s. per lb. can be readily obtained for it, according to quality. At present the demand is greatly in excess of the supply, and in order to encourage production enterprising firms of spinners exhibit at the leading rabbit shows displays of garments made from this wool. British spinners are said to prefer the wool produced by breeders in this country to that which is imported from abroad, but as they are unable to obtain home-produced supplies sufficient for their requirements, they are also buying extensively from France and other Continental countries. It therefore appears that the present time is favourable to an increase in the number of Angora rabbit breeders in this country.

The Angora is the only breed of rabbit that has a coat fine enough and long enough to justify its description as "wool" instead of "fur" or "hair." This wool grows rapidly from the time of weaning, and in a mature specimen reaches from 7 to 10 inches in length. It is described by spinners as being the finest material in the world for the weaving of certain classes of garments, *e.g.*, fine underwear, children's coats and caps, and as a trimming for court gowns. Further, the yarn is exported to America and other countries in considerable quantities.

Although Angoras are bred in various colours in addition to white (blues, smokes, fawns, etc.), the whites are the most popular and the most suitable for wool production.

Angoras are clipped about every three months. Approximately, one rabbit produces 10 oz. of wool per annum. Some specimens provide more, but breeders have found by experience that the wool from a single rabbit in one year can safely be calculated to be worth 30s., and that the animal's "keep" during that period will not exceed 10s., leaving a gross profit of 20s. If properly managed, therefore, 50 rabbits are capable of considerably increasing the income of persons who may be in a position to keep them properly.

It is not the writer's desire that anyone at this stage in the development of the Angora wool industry should endeavour to make this branch of live-stock culture his or her sole means of livelihood, but it can certainly be made to augment one's income. Neither does he advise the new enthusiast to aspire to the keeping of a head of rabbits exceeding about 100. Large wool farms may be developed, but they require experienced management, and paid labour has to be employed.

Wool is not the only product of the Angora rabbit. There are two others—pelts and flesh. The white skins are a good imitation of white fox. They are soft, warm and attractive. The pelts also supply the material for the making of necklets, muffs,

FIG. 1 —Angora Rabbit.

stoles, etc., and as linings for certain classes of garments they are said to have no equal. The coloured skins are used for similar purposes.

The meat of the Angora rabbit is excellent for the table. It is described by those who have tasted it as being more delicate, succulent and tender than the flesh of other breeds.

Although money may be made by the sale of the pelts and flesh, the writer's advice is that the rabbits—if suitable—should as a general rule, be kept alive and sheared for their wool. There is another point which all keepers of Angora rabbits should keep before them, and that is breeding for exhibition. Shows are held all over the country at which classes are provided for this breed of rabbit. There they can win many valuable prizes. and in consequence of these successes their value is so greatly enhanced that they may be sold at good prices, as much as £20 and £30 each being sometimes paid for good specimens. Further, a big winning buck can be placed at stud at a remunerative fee, and produce considerable revenue.

Angora rabbit wool is collected by the Universal Angora Club, an organisation of which every breeder should be a member. The wool should be sent to the Hon. Sec (Mr. J. Holmes, 44, Old Birch, Darwen), who forwards it to the spinners every two months, and the producers receive their cash within a few days of the despatch of each consignment. Mr. Holmes will be pleased to forward particulars of the club and its work to anyone who contemplates commencing with Angoras. The annual subscription to the club is 5s., with 1s. entrance fee.

As regards housing and general management, the Angora differs but little in its requirements from other rabbits, and the necessary information can be obtained from ordinary text-books on the subject, or from the Ministry's Leaflet No. 265. In establishing a stud it is essential that stock of good quality and size should be purchased at the outset. The bucks and does should have coats of even length and fine texture. Rabbits should not be mated when moulty. Angoras are prolific breeders, and the usual litter is from four to eight.

In conclusion it may be mentioned that Angora rabbit breeding is a particularly suitable hobby or side-line industry for women, among whom are some of the most successful breeders of the day.

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FEBRUARY ON THE FARM.

J. R. BOND, M.Sc.,
Agricultural Organiser for Derbyshire.

Weather.—The popular impression is that February is normally a wet month. Records extending over long series of years prove, however, that for the greater part of England the rainfall, on the average, is lower in this than in any of the other eleven months of the year except April. On well-drained land in the less rainy—the eastern and midland—parts of the country, the soil frequently is at this period dry enough for certain tillage and sowing operations. In the western districts, on the contrary, February is not normally a dry month, and here opportunities for early cultivations are comparatively rare. This difference has something to do with the proportions of arable and grass land on the two sides of the country.

February weather may be either very wet or very dry: in different years it tends towards the extreme in one or other direction. For instance, in 1921 rain fell in Derby on only 5 days during the month, the total rainfall for which was so low as 0.35 inch; but in the following year there were 18 wet days and a total of 3.03 inches of rainfall in the month. Similar variations may occur with regard to temperature. There is thus no certainty about the state of the land at this time of the year. Nevertheless, it not infrequently happens that opportunities missed in February do not return till late in spring; hence the advisability of being prepared to go forward with the sowing of one or other of the crops—rye, beans, peas, spring wheat, barley or winter oats—that may be put in a few weeks in advance of the ordinary spring seedings.

Spring Wheat.—If the farmer has at hand seed of any of the early-ripening varieties of winter wheat, such as Standard Red, Squarehead's Master, Victor or Little Joss, and if the land comes into sowing condition during February, he may sow and reasonably expect to reap a crop similar in yield and time of ripening to the produce of seed drilled late in November. In certain seasons, such as that following the severe winter of 1916-17, early spring sowings may give better results than crops put in before mid-winter.

It might be inadvisable to buy seed of any of the above four kinds for February sowing, excepting perhaps Little Joss. Squarehead's Master does well if sown early enough; but most of the recorded results from spring sowings of this variety have shown it to be very unsatisfactory and liable to failure when sown after the end of February. Standard Red very closely resembles this variety and may for the purpose of these remarks be regarded as identical with it.

With Little Joss, sowings may if necessary be deferred until about the middle of March. It has been known to yield even better than Red Marvel when sown by the 15th of that month: for instance a farmer who occupied heavy land near Loughborough recently informed the writer that Little Joss sown on the 15th of March had, in 1921, and again in 1922, yielded him 7 quarters per acre, Red Marvel sown at the same time in 1921 producing a quarter less.

If a farmer intended to buy seed wheat now for sowing at the first opportunity, he would be adopting the safest course if he ordered Red Marvel. This variety, while yielding best when sown early, can in the good wheat districts be sown with reasonable likelihood of success at any time to the end of March. Its yields in trials conducted by agricultural educational institutions have been as follows:—

County.	Year.	Date of sowing.	Yield of saleable grain. Bushels per acre.
Essex (Institute) ...	1911	23rd February	53 and 45
,, ,, ...	,,	20th March	48
,, ,,	1912	27th ,,	36 and 42
,, ,, ...	1913	11th ,,	35
Notts. (College) ...	1915	5th ,,	34
Herts. (Rothamsted) . .	1917	16th ,,	25 and 28
Yorks (Garforth) ...	1922	22nd ,,	20

The usual rate of seeding is 3 bushels per acre, but a little more should be put on when broadcasting. Unless the land is in high condition it should receive a complete dressing of artificials.

February Sown Oats.—Oats sown this month escape the attacks of the frit-fly grub when later sown crops suffer severely; and on light dry land early sown corn often succeeds when crops put in later are badly checked by drought or overtaken by annual weeds, such as charlock and spurrey. Also on heavy land that bakes in the summer, a crop that shades the soil early has a distinct advantage over one that is late in covering the ground. Hardy oats may be preferable to spring wheat in the cooler districts: and on cold soils where neither spring wheat nor barley give satisfactory results, February oats have generally succeeded. Also in upland districts good and comparatively early crops of oats have been obtained with hardy varieties, sown some weeks earlier than local opinion fixes as the proper time for sowing spring corn in those parts.

There is not quite the same distinction between winter and spring varieties in oats as there is in wheats: spring oats are capable of withstanding or recovering from the effects of moderate frost, while a very severe frost may almost destroy winter oats. Still, there is sufficient difference in hardiness to make it advisable to prefer varieties of the winter or half-bred winter oat class for February sowing. Bountiful (black winter) is the sort most commonly adopted for early sowing in Derbyshire; but the writer has seen good crops of Goldfinder (yellow half-winter) and of Marvellous (white winter) sown at the time in question. Bountiful and Goldfinder are well known to be useful as spring varieties; but when sown in March or April alongside the best spring sorts (such as Crown, Victory or Record) they ripen about a week later and yield rather less than the latter. Ordinary grey winters may also be sown in February or March and may be preferred for poor soils; on good moist land, however, they are too subject to lodging, and under these conditions the stiffer strawed and larger grained varieties are capable of higher yields.

The quantity of seed required differs according to the variety, Grey winters have small seeds and tiller well: 3 bushels per acre will suffice in this case. Marvellous has the opposite characteristics and probably 5 bushels would not be too much with this variety. Goldfinder and Bountiful require about 4 bushels. Special manuring is not, as a rule, called for. As regards cultivations, rolling, even where practicable, is usually inadvisable at this time of the year.

Preparing for Root Crops.—Land that was autumn- or winter-ploughed in unbroken seam often begins to assume a dry aspect early in the season (broken work may lie wet rather longer). This may be an opportunity for cross-ploughing, or of ploughing-back where cross cutting is not permissible. Rightly timed, a second ploughing is beneficial.

Where it has been or still is possible to spread the yard manure on the back of the furrow before cross-ploughing, the manure so applied will have decayed sufficiently and in time to allow of cleaning operations later in the spring. Turnips so manured are held to be less subject to fly troubles than crops to which the manure is applied in the ridges just before drilling. Early manuring affords certain other advantages in the matter of the method of preparing the seed-bed for root crops.

Clean land intended to grow mangolds on the ridge may with advantage be manured in the ridge at the earliest opportunity in February or March: it is not necessary to wait until the land has been reduced to a fine dry tilth before drawing out the ridges and covering-in the manure. For this crop it is important to have a well-settled bed of soil under the seed.

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MANURES FOR FEBRUARY.

H. V. Garner, B.A ,
Rothamsted Experimental Station.

Farmers' Field Trials.—Costly mistakes in manuring grassland may often be avoided by conducting a preliminary small scale trial on the field in question. A common case is one where it is uncertain whether basic slag alone will be satisfactory or whether kainit or lime will be required in addition. Under these circumstances, and particularly if the area to be treated is extensive, a season may well be devoted to an experiment. Since in most cases phosphate will certainly be necessary the whole area will receive its dressing of basic slag at the required rate, which would normally be about 7 cwt. per acre of the 30 per cent. grade or its equivalent. A representative plot of about an acre is then chosen and a few drill widths of ground lime is applied across it at the rate of 15 cwt. per acre. The experimental area is then crossed with a similar strip of kainit at about 4 cwt. per acre applied at right angles to the lime. There will then be the following alternatives to choose from:—1. Slag alone; 2. Slag + kainit; 3. Slag + lime; and 4. Slag + lime + kainit. The boundaries of the treatments are marked and the plots kept under observation for a season, when a manurial scheme for the whole area can usually be decided on.

Neutral Sulphate of Ammonia.—Inquiries are often made as to the difference between neutral sulphate of ammonia and the ordinary grade. The neutral material is supplied as a dry powder resembling fine sand in texture; it can be stored for an indefinite time in a dry shed without becoming sticky or lumpy; it contains practically no free sulphuric acid and can therefore be kept in the bags in which it arrives. Ordinary sulphate of ammonia is coarser and damper in texture; it absorbs moisture on storage and tends to form hard lumps; and the small amount of free acid it contains causes the bags to rot.

The neutral grade is always ready for use and since it stores so well it can be purchased when prices are favourable and kept till required. Its dry condition makes it specially suitable for mixing with other fertilisers.

The following are analyses and recent prices :—

Manure.	*Ammonia, per cent.*	*Equivalent to Nitrogen, per cent.*	*Price per ton, Buyer's Station.*	*Price per unit N.*	*Free Acid, per cent.*
Neutral Sulphate of Ammonia ...	25¾ ..	21·2 ...	£15 2s. ...	14s. 3d.	·025
Ordinary Sulphate of Ammonia ...	25¼ ...	20·8 ...	£13 19s. ..	13s. 5d.	·1 to ·3

Manures for Barley.—In working out a scheme for barley it is necessary to consider the effect of the manures on the quality of the grain as well as on the yield. Although season and soil have a much greater influence on quality than differences in manurial treatment, there is some experimental evidence as to the effect of manures, and this is being added to by the present experiments carried out under the research scheme of the Institute of Brewing at many centres throughout the country. Certain of the more definite conclusions from the earlier work may be summarised as follows :—

(1) Nitrogenous manures used alone tend to produce coarse grain of high nitrogen content and low quality. Unfortunately these manures are also the most effective in increasing the yield. The residues of heavy dunging or folding are similar in their action.

(2) Phosphates and potash improve the quality of the grain by increasing its starch and lowering its nitrogen content; but these manures have only a small effect on the yield, and unless used with a moderate supply of nitrogen, present in the soil or artificially applied, they are not likely to be remunerative.

(3) Complete artificial mixtures, such as, for example, 1 cwt. of sulphate of ammonia, 3 cwt. superphosphate, and 1 cwt. muriate of potash per acre, generally give a good yield of grain of high quality. On rich tilths it would be advisable to omit the sulphate of ammonia; on the heavier soils the potash could be reduced by one-half.

Regarding these statements in the light of the previous treatment of the land about to be drilled with barley, the following suggestions may be made :—After well done roots have been carted off, or after a straw crop on land in good condition, nothing will be required. If roots have been fed off by sheep receiving cake, the tilth will probably be too rich to grow first quality barley, and to counteract rankness 3 cwt. per acre of superphosphate may be given, adding ½ cwt. per acre of muriate of potash or its equivalent on land which is known to respond to potash. After carted roots grown without dung, or after a corn crop on land in only medium condition, a mixture of 2 cwt. per acre of superphosphate and 1 cwt. per acre of sulphate of ammonia would be suitable; while on light gravels and chalks 1 cwt. per acre of muriate of potash (or its equivalent of the lower grade potash manures) would be advisable in addition to the above mixture.

Kainit for Potatoes.—Experience has shown that sulphate of potash is the safest form of potash to use for potatoes where quality is the main consideration, while muriate of potash is slightly inferior in this respect. Lower grade sources of potash such as 12½ per cent. kainit, 20 per cent. potash manure salts, and the various grades of sylvinite are less certain in their action and often give a crop of inferior cooking quality. This detrimental effect is attributed to the common salt which is applied to the soil with the potash when kainit or sylvinite is used. Farmers who have crude potash manures on hand and hesitate to apply them for potatoes in the drills in spring, should consider the possibility of making the applications in winter, or as early as possible in spring, thus allowing the common salt to be washed out by the rain, while the potash is held back in the soil for the use of the potato crop. If a deep furrow is to be given to the potato land, the potash manures had better be applied after this operation to prevent them from being buried too deeply.

It should be noted that the above procedure cannot make crude salts equivalent in their action to sulphate of potash; but crude salts applied in winter should be nearly as effective as an equivalent quantity of muriate of potash applied in the drills in spring.

Leguminous Crops.—Manurial experiments on these important crops have been relatively few, but all evidence goes to show that peas, beans, vetches, clover, sainfoin, lucerne, etc., show a marked similarity in their food requirements. They are all highly sensitive to sourness in the soil, and liming is a necessary preliminary to growing good leguminous crops on soils poor in chalk; their response to farmyard manure either as a direct dressing or even as residues from recent dunging is considerable; good results are obtained from phosphates alone on strong land, and from phosphates helped out by potash on light soils; while direct applications of quick-acting nitrogenous manures are often ineffective and may even be harmful.

If the cereal crop which nursed the young clover or sainfoin did not receive a good dressing of phosphate, an application of 4 cwt. per acre of superphosphate or basic slag on stiff land, and of 1 cwt. per acre of muriate of potash (or its equivalent of crude potash salts) in addition on lighter soils, may still be given to the seeds. Lucerne or sainfoin leys that were not manured last year may have a similar dressing.

Spring beans or vetches would benefit from a dressing of dung if any was available, and also about 3 cwt. per acre of superphosphate; but if dung is not used the superphosphate may be increased to 4 or 5 cwt. per acre, and on lighter soils 1 cwt. per acre of muriate of potash or its equivalent should be given in addition to the phosphate.

Top Dressing Grass Land.—Grass land which is to be mown this summer and has not received dung in the previous year, will usually need a spring dressing to give bulk to the hay crop. For this purpose there is available sulphate of ammonia, nitrate of soda, or nitrate of lime. Sulphate of ammonia provides nitrogen at the cheapest unit price and is especially suited to soils which are well supplied with lime; it is retained by the soil and comes into action by degrees as the land warms up; if cold wet weather follows a top dressing there is less likelihood of serious loss when nitrogen is given in this form. The nitrates are dearer when reckoned on their nitrogen content, but against this it must be borne in mind that they yield in the soil compounds of soda and lime which reduce the loss of chalk from the land and also set free some potash for the use of the grass. They are slightly quicker in their action than sulphate of ammonia and should on no account be applied until the grass is capable of making immediate growth. The usual rate of application of these manures is 1 cwt. per acre.

Spring Wheat.—On account of its short period of growth, spring wheat requires more generous manurial treatment than wheat drilled in autumn. Phosphates will be required to give the young plant a good start and to hasten ripening, and for this purpose superphosphate is preferable to basic slag on account of its somewhat quicker action in the soil. A ready supply of available nitrogen should be provided, and this may be given either as sulphate of ammonia mixed with the superphosphate or as nitrate of soda as a top dressing. Suitable quantities for ordinary conditions would be :—3 cwt. per acre of superphosphate and 1½ cwt. of sulphate of ammonia applied before drilling; or 3 cwt. per acre of superphosphate before drilling and 1-1½ cwt. per acre of nitrate of soda as an early top-dressing. Potash is not required for corn on typical wheat land, but on lighter soils and chalks 3 cwt. per acre of kainit or sylvinite could be applied in addition to the above dressing.

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending January 9th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	.	13.15	13.10	13. 7	17. 3
,, ,, Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.19*	13.19*	13.19*	13.19*	(N)13. 5
,, ,, ,, neutral (A. 25¾ per cent.)	15. 2*	15. 2*	15. 2*	15. 2*	(N)14. 3
Kainit (Pot. 12½ per cent.)	...	..	...	2. 5	3. 7
,, (Pot. 14 per cent.)	2.10	2. 6	2. 5	2.10	3. 7
Sylvinite (Pot. 20 per cent.)	...	...	...	2.15	2. 9
Potash Salts (Pot. 30 per cent.) .. .	...	..	...	3.15	2. 6
,, ,, (Pot. 20 per cent.)	...	...		2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 5	7.10	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	..	...	11. 5	11. 5	4. 8
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
,, ,, (T.P. 30 per cent.) ...	...	...	...	2.17§	1.11
,, ,, (T.P. 26 per cent.)	2.13§	2. 0§	...	...	...
,, ,, (T.P. 24 per cent.)	2. 9§	1.16§	2. 0§	...	...
,, ,, (T.P. 20-22 per cent.)	...	1.13§	..	2. 5§	2. 3
,, ,, (T.P. 18 per cent.)	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.16	...	3. 7§	3. 7	1.11
,, (S.P. 30 per cent.) ...	3. 9	3. 2	3. 0§	3. 2	2. 1
Bone Meal (A. 4¼. T.P. 45 per cent.) ...	9.10	8. 5	8.15	8. 0	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6. 5	6. 5†	6. 5	6. 2	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	...	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

MONTHLY NOTES ON FEEDING STUFFS.

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Sugar Factory By-products.—In the manufacture of sugar from sugar cane or sugar beet, by-products arise which are of value to the stock feeder. Molasses is the important by-product from the sugar cane which is of value to the stock feeder in this country. Notes on the feeding value of molasses have already appeared in these notes, and should be consulted by those desiring further details on the feeding value of this by-product.*

Sugar Beet Slices.—The production of sugar from sugar beet has now reached a commercial stage in England, and considerable quantities of sugar beet slices are now on the market. In the process of manufacturing sugar, the beets are first washed and sliced, the slices being leached in a battery of extractors with warm water. The resultant slices contain very little sugar and may be fed either wet or dry.

Beet slices in their wet state contain 90 per cent. of water, and are chiefly fed to cattle. Fattening cattle and milch cows may be fed up to 50 lb. a head per day, while sheep and pigs may be fed up to 6 lb. per day per 100 lb. live weight. It is said that over-feeding milch cows with wet slices gives rise to hard white butter of inferior taste if the milk is used for butter making. Owing to the fact that wet slices readily decompose, it is usual to dry the slices at the factory at high temperature by means of a rotary drum. The resultant product has a pleasant odour and is greyish-brown in colour.

Feeding Value of Dry Sugar Beet Slices.—Like the wet slices, dried slices constitute a starchy feeding material, and should be fed in conjunction with feeding stuffs rich in protein and oil. If fed soaked the slices may be regarded as a root substitute, if fed dry, as a concentrate. The following quantities may be fed per head per day: Horses 5 lb., cows 7 lb., fattening cattle 10 lb., calves 2-3 lb., pigs 1-3 lb. The slices require soaking for at least 12 hours if it is desired to feed them in the wet state. If fed dry, it is important to accustom the stock to this material by gradually introducing it into the ration.

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* This *Journal*, November, 1921, p. 727.

DESCRIPTION.	Price per Qr.		Price per Cwt.	Price per Ton.		Manurial Value per Ton.		Cost of Food Value per Ton.		Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
	s. d.	lbs.	s. d.	£	s.	£	s.	£	s.		s.	d.
Wheat, British - -	—	—	10/3	10	5	0	16	9	9	71·6	2/8	1·43
Barley, British Feeding	—	—	9/9	9	15	0	12	9	3	71	2/7	1·38
„ Canadian No. 4 Western	34/9	400	9/9	9	15	0	12	9	3	71	2/7	1·38
„ Persian - -	32/9	„	9/2	9	3	0	12	8	11	71	2/5	1·29
Oats, English, White -	—	—	11/-	11	0	0	14	10	6	59·5	3/6	1·87
„ „ Black and Grey - - -	—	—	9/4	9	7	0	14	8	13	59·5	2/11	1·56
„ Scotch, White -	—	—	11/4	11	7	0	14	10	13	59·5	3/7	1·92
„ Canadian No. 2 Western	26/9	320	9/4	9	7	0	14	8	13	59·5	2/11	1·56
„ „ No. 3 „	25/9	„	9/-	9	0	0	14	8	6	59·5	2/9	1·47
„ Canadian Feed -	24/6	„	8/7	8	12	0	14	7	18	59·5	2/8	1·43
„ American - -	24/3†	„	8/6†	8	10†	0	14	7	16	59·5	2/7	1·38
„ Argentine - -	23/9	„	8/4	8	7	0	14	7	13	59·5	2/7	1·38
Maize, Argentine - -	42/6	480	9/11	9	18	0	13	9	5	81	2/3	1·20
„ South African -	41/-	„	9/7	9	12	0	13	8	19	81	2/3	1·20
Beans, English Winter-	—	—	10/9	10	15	1	12	9	3	67	2/9	1·47
„ Rangoon - -	—	—	8/3†	8	5†	1	12	6	13	67	2/-	1·07
Peas, Japanese - -	—	—	22/6†	22	10†	1	8	21	2	69	6/1	3·26
Millers' Offals :—												
Bran, British - -	—	—	—	7	10	1	7	6	3	45	2/9	1·47
„ Broad - -	—	—	—	8	7	1	7	7	0	45	3/1	1·65
Middlings Fine (Imported)	—	—	—	10	5	1	2	9	3	72	2/6	1·34
„ Coarse (British)	—	—	—	9	0	1	2	7	18	64	2/6	1·34
Pollards (Imported) -	—	—	—	7	15	1	7	6	8	60	2/2	1·16
Meal, Barley - -	—	—	—	10	15	0	12	10	3	71	2/10	1·52
„ Maize - - -	—	—	—	11	0	0	13	10	7	81	2/7	1·38
„ „ South African	—	—	—	9	7†	0	13	8	14	81	2/2	1·16
„ „ Germ -	—	—	—	9	15	0	19	8	16	85·3	2/1	1·12
„ „ Gluten-feed	—	—	—	8	17	1	7	7	10	75·6	2/-	1·07
„ Locust Bean -	—		—	8	5	0	9	7	16	71·4	2/2	1·16
„ Bean - - -	—	—	—	12	15	1	12	11	3	67	3/4	1·78
„ Fish - - -	—	—	—	20	0	4	6	15	14	53	5/11	3·17
Linseed - - -	—	—	—	23	8	1	11	21	17	119	3/8	1·97
„ Cake, English 9°/₀ Oil	—	—	—	13	15	1	18	11	17	74	3/2	1·70
Soya Bean Cake 6°/₀ Oil	—	—	—	12	0	2	14	9	6	69	2/8	1·43
Cottonseed Cake, English 5¼°/₀ Oil	—	—	—	7	15	1	15	6	0	42	2/10	1·52
„ „ Egyptian 5½°/₀ Oil	—	—	—	7	10	1	15	5	15	42	2/9	1·47
Decorticated Cotton Seed Cake 7°/₀ Oil -	—	—	—	12	0	2	14	9	6	71	2/7	1·38
Decorticated Cotton Seed Meal 7% Oil -	—	—	—	12	7†	2	14	9	13	71	2/9	1·47
Coconut Cake 6°/₀ Oil -	—	—	—	9	15	1	11	8	4	73	2/3	1·20
Palm Kernel Cake 5°/₀ Oil - - - -	—	—	—	7	10	1	3	6	7	75	1/8	0·89
Palm Kernel Meal 2°/₀ Oil - - - -	—	—	—	6	0	1	4	4	16	71·3	1/4	1·71
Feeding Treacle - -	—	—	—	7	0	0	8	6	12	51	2/7	1·38
Brewers' Grains :—												
Dried Ale - -	—	—	—	8	2	1	4	6	18	49	2/10	1·52
„ Porter - -	—	—	—	7	12	1	4	6	8	49	2/7	1·38
Wet Ale - - -	—	—	—	1	15	0	9	1	6	15	1/9	0·94
„ Porter - -	—	—	—	1	10	0	9	1	1	15	1/5	0·76
Malt Culms - -	—	—	—	8	10†	1	14	6	16	43	3/2	1·70

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 11s. per ton. The food value per ton is therefore £8 9s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 5d.; P_2O_5, 4s.; K_2O, 2s. 6d.

From the point of gauging the price, roots form the best comparison. From experiments carried out at Little Snoring with fattening cattle some years ago, it would appear that 14 lb. of dried slices are equivalent to 1 cwt. of roots in feeding value.

FARM VALUES.

CROPS.	Market Value per lb. S.E.	Value per unit S.E.	Starch Equivalent per 100 lb.	Food Value per Ton.	Manurial Value per Ton.	Value per Ton on Farm.
	d.	s. d.		£ s.	£ s.	£ s.
Wheat - - - - -	1·20	2 3	71·6	8 1	0 16	8 17
Oats - - - - - -	1·20	2 3	59·5	6 14	0 14	7 8
Barley - - - - - -	1·20	2 3	71·0	8 0	0 12	8 12
Potatoes - - - - -	1·20	2 3	18·0	2 0	0 4	2 4
Swedes - - - - -	1·20	2 3	7·0	0 16	0 2	0 18
Mangolds - - - - -	1·20	2 8	6·0	0 13	0 3	0 16
Good Meadow Hay - -	1·52	2 10	31·0	4 8	0 14	5 2
Good Oat Straw - - -	1·52	2 10	17·0	2 8	0 7	2 15
Good Clover Hay - -	1·52	2 10	32·0	4 11	1 0	5 11
Vetch and Oat Silage - -	1·38	2 7	14·0	1 16	0 7	2 3

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Importation of Live Stock into South Africa.

WITH reference to the note in the January, 1924, issue of this *Journal*, p. 887, relating to the closing of the Cattle Testing Station at Pirbright, Surrey, the Government of the Union of South Africa has prohibited the importation of cattle, sheep, goats and pigs from the United Kingdom, owing to the prevalence of foot-and-mouth disease. The regulations mentioned in the note above referred to are therefore in abeyance for the present.

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Report of the Development Commissioners for the year 1922-23.

THE thirteenth Report of the Development Commissioners, for the year ending 31st March, 1923, has just been issued by H.M. Stationery Office.* It contains a valuable record of the effort that is being made by the State to improve British agriculture by means of a complete system of education and research.

The purposes for which grants are at present given are as follows:—

(1) Research Institutes and Stations, each dealing with a separate group of problems.
(2) A staff of scientific men for advising farmers in their technical difficulties.
(3) Special research grants to individual research workers.
(4) Fellowships to enable members of the staffs of the Research and Advisory service to travel and study the methods of other scientific workers; and scholarships for training young graduates.
(5) Agricultural education—building and equipment of colleges, extension work of colleges, farm institutes and classes provided by Local Education Authorities, scholarships.
(6) Miscellaneous agricultural schemes.

The total amount recommended by the Commissioners for expenditure on agriculture and rural industries in 1922-3 was approximately £438,000, of which £16,450 was loaned. £214,000 of the total was provided by the ordinary Development Fund, and the remaining £224,000 came from the special grant of £850,000 which was paid into the Development Fund under the Corn Production Acts (Repeal) Act, 1921.

The New Fund.—The principal feature during the year 1922-23 was the allocation of this £224,000 from the new fund. The chief objects for which advances from it were made are:—

(1) Additions to the lands and improvements to the buildings at research institutes and agricultural colleges.
(2) Extension of the advisory scheme.
(3) Increase of help to local authorities for agricultural education.
(4) Provision for scholarships for children of agricultural workers.
(5) A scheme for the development of the poultry and livestock industry.

Agricultural Economics Service.—This service, an extension of the Advisory Scheme. has been inaugurated during the year with the object of providing economic guidance for farmers. Economic studies were already being carried out at the Oxford Institute for Research in Agricultural Economics, and Leeds

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* To be obtained directly or through any bookseller from H.M. Stationery Office, Kingsway, London, W.C. 2; or Manchester, Edinburgh, and Cardiff. Price 4s. net.

University had given much attention to the subject.* The scheme provided for the enlargement of the Leeds department and the creation of new costings departments at Cambridge University, Reading University College, and Wye College. These will all work in conjunction with the Oxford Institute, and in the first instance will concentrate on preparing cost accounts for selected farms on a common plan.

National Poultry Institute.—The grant of £850,000 enabled those associated with the poultry industry to bring forward a scheme for the establishment of a long-desired poultry institute. Originally the promoters had in view the foundation of a single central institution, but a full examination of the project by the Ministry and its Poultry Advisory Committee led to the conclusion that better results would be got by dividing up the problems which face the poultry keeper under separate headings, most of which could be more effectively dealt with at existing institutions than at a single central institute.' Accordingly a scheme has been adopted for work to be done on poultry nutrition at the Cambridge Animal Nutrition Institute, on diseases at the Ministry's Veterinary Research Laboratory, on breeding at the Cambridge University Department of Genetics, and on education and commercial problems at the Harper Adams Agricultural College. The capital required for buildings and equipment at these places is estimated at £26,000 and maintenance at £6,000 per annum. The Development Commission will provide three-fourths of the capital and the whole of the annual expenditure which they consider necessary.

National Federation of Women's Institutes.—This organisation has continued to show great vitality and powers of expansion, 455 new Institutes having been formed during the year 1921-22 and 347 during 1922-23, bringing the total number in existence up to 2,674 with a membership estimated at 160,000. The number of voluntary organisers trained by the Federation increased during the same period from 146 to 215. The formation of county federations has been further extended, the work being completed in the English counties, and only five Welsh counties being without federations. It should be borne in mind that the individual Institutes finance themselves and contribute to the maintenance of the headquarters staff and the county federations, and that the grant from the Development Fund goes towards the cost of organisation. It is a satisfactory sign of the strength of the movement that, in spite of the depressed condition of the agricultural workers, the call on public funds becomes less each year. For 1921-22 a grant of £7,250 (including £600 for training in handicraft work) was sanctioned by Your Lordships. For 1922-23 a grant of £4,825 (including £700 for handicraft purposes) was approved, but of this only £3,941 was actually paid over, while for 1923-24 it was found possible to reduce the grant to £3,456, of which £856 was for handicraft instruction. This progressive reduction was due partly to economies effected by the headquarters organisation and partly to an increase in the revenue derived from affiliation fees, interest on the endowment fund, donations and sales of literature, which actually amounted to £3,781 for the year 1922-23, and was estimated at £4,350 for the year 1923-24. At the end of the year 1922-23 the Endowment Fund stood at approximately £14,115. The Federation is now extending its handicraft teaching to others besides Institute members. Classes for men and boys will be given by teachers trained at the Handicrafts Schools, and an effort will be made to organise the production of work for sale (as distinct from recreational and thrift work) by village women wherever the demand arises. It is hoped that this may do something to relieve distress arising from the depression in agriculture.

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* See this *Journal*:—*The Cost of Manual Labour in Milk Production*, August, 1922, p. 411; *Labour on the Farm*, Nov., 1922, p. 697, and Dec., 1922, p. 801; *When should the Farmer sell Home-Grown Foods*, Dec, 1922, p. 783; *Farm Capital and Profits*, Feb., 1923, p. 984.

Agricultural Education.—A striking result obtained from the new fund is the re-establishment of the Royal Agricultural College, Cirencester, which was closed during the War, as nearly all the staff and students had joined the Forces. The Development Commission recommended a capital grant of £15,000 for extending the existing buildings, and £2,000 in aid of the first year's maintenance, and the College was re-started at the beginning of the academic year with a good entry of students.

Scholarships for Agricultural Workers.—£100,000 of the new fund has been allocated to establishing scholarships and maintenance allowances for the sons and daughters of agricultural workmen and others. The Ministry of Agriculture and the Board of Education set up a Committee to prepare a scheme for the expenditure of this sum. and as a result, ninety-two scholarships were awarded for 1922-23, at an estimated cost for that year of £10,000. For the next year £20,000 has been approved.

The above are no more than examples of the work supported by the Development Fund. All who are interested in agri-tural development will find in the complete report an illuminating account of the progress already made in agricultural research and education and the prospects opened up by it.

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Prizes for Small Holders.

WITH a view to encouraging small holders in the best methods of cultivating their holdings, prizes have been offered at some recent agricultural shows for the best cultivated small holdings in the district. One of the Ministry's District Commissioners has seen the prize-winning holdings under a competition of this kind organised by the Hertfordshire Agricultural Society, and reports that they do the tenants great credit. Similar competitions have been or are about to be arranged in connection with several other agricultural shows, including that of the Bath and West and Southern Counties Agricultural Society, and these should have a very stimulating and beneficial effect on the small holders in the districts concerned.

It is interesting in this connection to note that several cases have been brought to the Ministry's notice where prizes of various kinds in open competitions have been won by tenants of County Council small holdings. A Westmorland holder was successful with a pen of ducks bred by him in winning the *Daily Mail* Cup in 1923 in an Egg-Laying Competition over a period of twelve months open to Britain. Numerous successes by tenants of the Leicester County Council have been obtained at various live-stock shows in the county during the past year, and the possibility of organising special classes for small holders at next year's shows in Leicestershire in under consideration.

A further instance of the enterprise and success of small holders is afforded by the fact that no fewer than 76 entries by tenants of the North Riding of Yorkshire County Council were made at the Rural Industries Exhibition, and 5 first, 7 second, and 7 third prizes were secured, chiefly for roots and ears of corn.

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The Agricultural Index Number.

THE general index number of the prices of agricultural produce showed a further slight advance in December, the average increase over the corresponding month in the years 1911-13 being 56 per cent. as against an increase of 53 per cent. in November. The rise during the past two months has thus brought the general level of prices to only 8 points below that of December, 1922.

In the following table are shown the percentage increases monthly since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	53
August	193	131	67	54
September	202	116	57	56
October	194	86	59	51
November	193	79	62	53
December	184	76	59	56

Following the improvement in wheat prices which occurred during November, the December figure showed a further decided advance, averaging 33 per cent. above the pre-war price as against 22 per cent. in November. The end of the month witnessed a somewhat easier tendency, however. Oats also realised considerably higher prices than in the previous month, but barley was slightly cheaper, although the fall was less pronounced than is customary at this period.

Potatoes again advanced, December prices being nearly £1 per ton higher than those for October, and little less than double the pre-war average. There is no weakening in the markets, and further advances are probable in the near future. Hay remains at about its pre-war level.

Fat cattle and sheep advanced in value in December, but whereas the rise in cattle prices was relatively greater than the normal increase before the war, sheep advanced by less than the pre-war average. Hence the index figure for cattle shows a rise on the month, while that for sheep shows a fall. Fat pigs continued the downward trend which had only twice been interrupted since the beginning of the year. The prevalence of foot-and-mouth disease and the consequent restrictions imposed upon trade, prevented the calculation of average prices of store stock and dairy cows in December.

The main cause of the advance of 3 points in the general index number was the rise in milk prices. Under the National Farmers' Union scheme producers received 1s. 8d. per gallon in December, for milk delivered to buyer's station, as compared with 1s. 5d. in November, and although the scheme is not operative throughout the country and has not been universally adopted, the general level of prices rose from 75 per cent. above the pre-war average in November to 90 per cent. in December. Butter also advanced, but cheese was slightly cheaper than in November.

A substantial advance was recorded in poultry prices during the month, far exceeding the normal pre-war increase at this season, with a resulting increase of 19 points in the index number. Eggs, on the other hand, declined to a relatively greater extent than was usual before the war, and the index number for December is 6 points lower than that for November.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	Dec.	August	Sept.	Oct.	Nov.	Dec.
Wheat ...	32	29	19	20	22	33
Barley ...	17	9	30	25	25	27
Oats	36	30	30	25	24	30
Fat cattle ...	48	46	45	44	47	49
Fat sheep ...	81	76	72	76	77	72
Fat pigs ...	94	52	55	48	47	43
Dairy cows ...	72	51	52	61	57	—
Store cattle ...	28	28	27	27	25	—
Store sheep ...	83	101	109	99	88	—
Store pigs ...	151	102	95	82	75	—
Eggs... ...	63	68	75	92	92	86
Poultry ...	86	61	67	65	58	77
Milk	90	67	67	72	75	90
Butter ...	73	48	56	61	64	68
Cheese ...	60	67	74	76	73	71
Potatoes ...	7	80	75	62	80	91
Hay	47	34	32	7	—1*	0

* Decrease.

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Manures from Town Waste.

THE Corporation of Birmingham has long been noted for its municipal activities. Its gas, electric light and water departments have all been very successful, but a department which has only been running a few years and deals with town waste is of special interest to farmers, who, however, have not yet made the direct use of it that they might.

Under the direction of Mr. J. Jackson, its Superintendent, a great "Wealth from Waste" campaign has been started by the Salvage Department, and as a result, manures and feeding stuffs of various types are now available at a reasonable rate. For instance, 4,000 tons of slaughter-house and similar material is dealt with every year, yielding nearly 1,000 tons of the finished product. This includes fish and meat meals with 51 per cent. of albuminoids, together with fish, meat, bone and other manures with varying analyses, which are priced according to the unit value.

What is known as slaughter-house manure contains 6 to 7 per cent. of ammonia and the same percentage of phosphates, and is offered at £8 10s. f.o.r. Birmingham. It is produced from the stomach contents of various beasts and contains a large amount of humus in the form of fibre. In other forms the fibre is taken out so that the manure can be drilled. The fibre is in great demand by hop and fruit growers. One of the most interesting of the productions, although naturally there is only a limited supply, is the ash made by burning banana stalks. This fertiliser contains 50 per cent. of potash.

Farmers in the neighbourhood of Birmingham have produced good crops by the use of these products. There is no trouble in getting rid of the 17 to 18 tons that are available each week, and most of it is readily sold to middlemen who apparently use it for compounding artificial manures.

Another material which can hardly be called manure, but which is very useful on heavy land, is the dust from household refuse, which has passed through a $\frac{3}{8}$-in. sieve. At present it only contains 1 per cent. of nitrogen and 1 per cent. of phosphates, but it is hoped to increase this percentage by adding vegetable refuse. At present this can be delivered within a few miles of Birmingham at 4s. or 4s. 6d. per ton.

The Department has an analytical laboratory with a trained staff and is able both to analyse the various materials and to give advice as to any necessary additions which should be made for specific crops. Not only farmers but allotment holders are catered for by this Department, and prices are quoted for quantities as low as 14 lb. either at the depot or delivered anywhere in Birmingham for a few pence extra.

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Grants to Research Institutes.

THE Treasury, on the recommendation of the Development Commissioners, have approved grants to Agricultural Research Institutes for work to be carried out during the year ending 30th September, 1924, as shown in the statement below:—

INSTITUTE.	GRANT SANCTIONED.
	£
Aberystwyth : Plant Breeding Institute	5,800
Bristol : Agricultural and Horticultural Research Station	11,800
Cambridge : Animal Nutrition Institute	9,700
Plant Breeding Institute	5,600
Small Animal Breeding Institute	1,150
Horticultural Research Station	1,420
Silver Leaf Research	1,550
East Malling Research Station	6,300
Imperial College of Science and Technology	5,100
London School of Tropical Medicine	2,550
Oxford : Institute for Research in Agricultural Economics	4,950
Reading : National Institute for Research in Dairying	8,800
Royal Veterinary College	4,500
Rothamsted Experimental Station	22,780
Waltham Cross Experimental Station	2,000
	£93,170

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Milk Recording for Goat-Keepers.

IT is not surprising that goat-keepers should have taken note of the success of the Ministry's scheme of milk recording for cows. The more advanced goat breeders have come definitely to the conclusion that milk recording for them has become a necessity if they are to improve their milking herds and keep abreast of the times.

For some years the subject has been discussed in the goat press, and about four years ago the Ministry agreed that goats might be recorded under its scheme on the same conditions as cows, if the milk recording societies concerned considered the size of the herd would justify the labour and expense incurred in checking the records.

As a result of this permission, eleven goat owners recorded 85 goats during the year ending 1st October, 1922, and nearly double that number of goat owners are now recording under the official scheme.

These eleven owners are members of six different milk recording societies. Of the five herds which were recorded for the full year of operations, four herds contained goats which gave records of between 200 and 300 gallons.

Under the official scheme the cost per head of recording is of course much higher, proportionately, for goats than for cows, taking into account the respective values of the animals and the amounts of milk given. The goat keeper is also adversely affected by the fact that herds of goats are on an average very much smaller in numbers than are herds of cows. Thus the minimum charge per herd which is made by milk recording societies is not always reached by the total of the subscriptions and the levies for each goat entered.

The fact that milk recording for goats is advancing in spite of these obstacles indicates strong belief among goat owners in the value of membership of a Society recognised by the Ministry.

Subscriptions and levies charged by milk recording societies vary considerably in different parts of the country. The following are the charges made by those societies under which goats are recorded :—

Society.	*Subscription.*	*Levies.*		
Surrey	10/6	5/- per head	*Min. £5 10 6	per herd
Hants	5/-	5/- „	„ £4 0 0	„
Essex	£1 1 0	3/- „	„ £1 10 0	„
Northants	10/6	4/- „	„ £3 0 0	„
Lancs	£2 0 0	4/6 „	„ £2 5 0	„
Worcester	£1 0 0	5/- „	„ £2 0 0	„

* Minimum

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AGRICULTURE ABROAD.

Wart Disease Regulations in Prussia.*

THIS new potato wart disease order, issued by the Prussian Minister of Agriculture on 27th September, 1922, is an amendment of that of 18th February, 1918, and applies to the entire State of Prussia.

Potato fields and stored potatoes are liable to inspection, with a view to the control of wort disease [Synchytrium endobioticum]. Inspection may be extended to fields intended for potato cultivation or which have already been harvested. It will be carried out by the local police authorities and officials of the plant protection headquarters. The inspectors are authorised to remove suspected tubers, etc., for examination. Owners and occupiers of ground and stores or their representatives observing symptoms of wart disease (described in an appendix), on growing or stored potatoes are required to notify within 24 hours the police or local authorities, who in their turn must immediately inform the plant protection headquarters. The decision of the latter or their representatives is final.

The refuse of plants growing in infested fields must be carefully collected and burnt, or buried at least half a metre deep where burning is impossible. Potatoes harvested from infested fields must neither be used for seed nor removed from their

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*See *Nachrichtenblatt für den deutschen Pflanzenschutzdienst*, ii, 12, pp. 102-104, 1922.

place of growth without permission from the police, issued on approval by the plant protection headquarters. They can only be used for fodder when cooked or steamed. The residue from such potatoes must also be burnt. Where factories for the preparation of potato products are near by, it is best to hand over the tubers from contaminated fields to such factories, but any unnecessary movement of the tubers is to be avoided on account of the danger of transmitting infection in particles of soil adhering to them.

Only the potato varieties specially authorised by the local police authorities may be cultivated in infected fields until further notice. Removal of such restriction must be approved by the plant protection headquarters. The only varieties admissible for this purpose are those listed as immune from wart disease in the annual circular of the Biological Institute. Seed potatoes are to be procured only from fields approved by a Chamber of Agriculture, the Potato Cultivation Society, the German Agricultural Association, or the National Agricultural Federation. Stable or liquid manure must not be sold by, or otherwise distributed from, infected farms. Cellars and other rooms employed for the storage of diseased potatoes must be disinfected with limewash after use.

The above regulations do not apply to official experiment stations, in the case of scientific research, or to the removal of samples by the inspection authorities.

In case there is ground for suspicion that the infection has been, or is likely to be, transmitted to other fields, the above regulations may be applied to all the fields within an area to be defined by the police authorities in accordance with the finding of the plant protection headquarters.

If infected potatoes are found elsewhere than on agricultural premises the stock must also be rendered harmless or disposed of for manufacturing purposes under the supervision of the local police authorities.

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Seed Grain Competitions in Quebec.

A NOTE in this *Journal*, September, 1923, p. 560, described a French and Belgian system of competitions intended to secure the widespread adoption of the results of modern research in crop breeding. Competitions with the same object have also been carried on in the Canadian province of Quebec since 1919.* These competitions are designed to encourage the use for seed of the grain produced.

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* *Agriculture Gazette of Canada*, Sept.—Oct., 1923.

Farmers desiring to enter the competition are required to own a certain amount of seed grain of standard quality and of a known variety approved by the Department of Agriculture. The standing crops entered by their growers are inspected and points are given for the general appearance of the crop, absence of weeds and diseases, system of cultivation, etc. The interesting feature of the competitions is that the farmers are then required to prepare a large proportion of the grain for seed. An inspection of the cleaned seed is made and points given according to the thoroughness of the work done during the course of all the operations.

This constitutes the difference between the combined field crop and cleaned seed competition and the former standing crop competitions, and prevents well-to-do farmers from putting their crops into the competition as a speculation without any results as regards the improvement of cereal crops by the more general use of improved seed.

The contests are organised under the auspices of the agricultural associations, with the co-operation of the Provincial Department of Agriculture. During the three years, 1920-23, the annual number of competitions has increased from 16 to 29 and the entries from 472 to 1,297. In the third year 28,400 bushels of seed oats and 7,500 lb. of clover seed were inspected.

The increase in the number of contests and entries suggests their popularity among farmers and the benefits derived from them. The consensus of opinion is that the competitions are a means of distributing good varieties of crops among the farmers, that they encourage the use of methods of selection, and create an *élite* of farmers who are able to produce seed of good quality of uniform variety, and well adapted to climatic and soil conditions. It is hoped that as the work becomes generalised throughout the province the average yield of crops will show a decided increase.

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Agricultural Prices and Distribution in Sweden.

A COMMISSION of Investigation has recently been inquiring into the organisation of the system of distributing foodstuffs in Sweden. In its report, it states that owing to the increase in prices during the War and the withdrawal of State control thereafter, middlemen found themselves in a position to obtain unreasonable profits in many directions. Latterly, however, values had considerably declined, and with the unusually abundant supplies of goods, the evil had to a large extent disappeared. In consequence the Commission did not recommend any interference by the State with ordinary economic conditions in Sweden at the present time. It did, however, recommend that Local Authorities should make themselves acquainted with the local circumstances of important trades and assist them where they could in reducing expenses through representations to transport authorities, etc. The Commission expresses its firm conviction that the co-operation of consumers and producers forms the best means of removing any undue expense of intermediate services in the marketing and sale of commodities, and it recommends that an intensive educational campaign should be carried out to bring the fact home to those concerned.

The Commission also submitted that the Government should (1) order that a continuous service of statistics of producers' prices should be organised; (2) that Communal Prices Committees should be set up to watch prices in towns or districts; (3) that obligatory instruction in economic theory and practice be given in suitable schools; (4) that Parliament should vote 10,000 crowns annually as a contribution to a central organisation for the development of economic co-operation.

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Foot-and-Mouth Disease.—Since 12th December, 1923, the following fresh centres of disease have been brought to light:—

(1)	On	15	December,	Deal, Kent.
(2)	,,	18	,,	Ulverston, Lancs.
(3)	,,	19	,,	Norwich.
(4)	,,	24	,,	Whitehaven, Cumberland.
(5)	,,	29	,,	Boreham, Chelmsford.
(6)	,,	30	,,	Sulby, Northants.
(7)	,,	30	,,	Mildenhall, Suffolk.
(8)	,,	30	,,	Macduff Gamrie, Banff.
(9)	,,	31	,,	Aldborough, Yorks, E.R.
(10)	,,	5	January,	Silverstone, Northants.
(11)	,,	8	,,	Carmythe, Forfar.
(12)	,,	12	,,	Ely, I. of Ely.
(13)	,,	14	,,	Kirkby Stephen, Westmorland.

Outbreaks.—The table on p. 1077 shows the number of outbreaks during the period 12th December, 1923, to 19th January, 1924, inclusive, and during the outbreak from 27th August last.

Restrictions.—With the release of the controlled area on 15th December, 1923, the general restrictions, so far as movement of animals is concerned, have remained practically unchanged, save for the variation of the limits of the infected areas from time to time on account of the new outbreaks or of the cessation of disease in some districts.

FOOT-AND-MOUTH DISEASE, 1923—1924.

England and Wales.	Dec. 12-15.	Week ending Dec. 22.	Week ending Dec. 29.	Week ending Jan. 5.	Week ending Jan. 12.	Week ending Jan. 19.	Total during Outbreak from 27 Aug., 1923, to 19 Jan., /24.
Bedford	—	—	—	—	—	—	1
Birmingham ...	—	—	-	—	—	—	6
Chester	137	190	212	160	110	63	1,312
Cumberland ...	—	—	4	5	4	1	14
Denbigh	1	8	3	3	3	—	79
Derby — ...	1	1	3	3	3	3	21
Devon	—	—	—	—	—	—	4
Durham	10	5	2	1	4	2	91
Essex	—	—	1	—	—	—	6
Flint	3	14	6	4	7	5	77
Gloucester	5	5	4	—	3	4	59
Isle of Ely	—	—	—	—	1	—	1
Kent..	1	3	—	—	1	—	8
Lancaster	2	9	12	8	8	5	79
Leicester	—	1	2	2	2	1	15
Lincs., Lindsey ..	—	—	—	—	—	—	2
London	—	—	—		—	—	1
Monmouth	—	—	—	—	—	—	1
Norfolk	—	1	—	2	2	—	10
Northampton ...	—	—	—	2	—	3	5
Northumberland .	5	7	4	3	5	4	71
Nottingham ...	—	—	2	—	—	—	3
Salop	11	20	20	19	16	9	151
Somerset	—	—	—	—	—	—	7
Southampton ...	—	—	—	—		—	7
Stafford	1	6	18	21	10	4	71
Suffolk	—	—	—	2	1	—	3
Surrey ..	—	—	—	—	—	—	7
Sussex, East ...	—	—	—	—	—	—	1
Warwick	3	1	2	4	—	1	13
Westmorland ...	—	—	—	—	—	1	1
Worcester	2	5	2	3	3	1	26
York, East Riding...	—	—	—	1	1	3	8
„ North „ ...	—	3	7	4	2	1	22
„ West „ ...	5	7	6	3	1	2	85
TOTALS — England and Wales ..	187	286	312	250	187	113	2,268

Scotland.	Dec. 12-15.	Week ending Dec. 22.	Week ending Dec. 29.	Week ending Jan. 5.	Week ending Jan. 12.	Week ending Jan. 12.	Total during Outbreak from 27 Aug., 1923, to 19 Jan., /24.
Aberdeen	—	—	—	1	—	—	4
Ayr	1	—	—	—	—	—	4
Banff	—	—	—	2	3	—	5
Dumberton... ...	1	1	—	—	—	—	23
Kinross	—	—	—	—	—	—	1
Fife	1	—	2	1	—	—	5
Forfar	—	—	—	—	1	—	1
Lanark	4	1	3	2	2	2	26
Perth	—	—	—	—	—	—	5
Renfrew	—	—	1	—	—	—	25
Stirling	—	1	2	—	—	—	14
TOTALS—Scotland .	7	3	8	6	6	2	115
TOTALS — Great Britain... ...	194	289	320	256	193	115	2,383

As from 4th January, 1924, a consolidating Order was issued restating the various areas, other than those in the North Midlands (Ches., &c., Area), Kent, Renfrew district, Fife and Perth district, Aberdeenshire, and Forfarshire, comprised under separate Orders.

Restrictions on Hunting.—On 19th December, 1923, a Circular Letter was issued by the Minister intimating that in consequence of strong representations from the National Farmers' Union and from farmers individually, it had been decided to issue an Order prohibiting hunting in infected, controlled or prohibited areas. The Order, which operated on 24th December, also prohibited whippet-racing and coursing.

Restrictions on Imported Animals.—On the 20th December the Ministry extended the period of detention at the farms of destination of all imported animals from 14 to 28 days. The movement of imported animals is now permissible only direct to a slaughterhouse for slaughter therein, or to private premises for detention for the period specified, during which no movement is permitted.

World's Poultry Congress, 1924.—People who are interested in the development of the British Poultry Industry should bear in mind the World's Poultry Congress and Exhibition, which will be held in Barcelona and Madrid in May next. Programmes are now available for this gathering of poultry-keepers from all over the world, and there is sufficient evidence forthcoming to indicate that the Congress will not only be of great interest to all who attend it, but that it may prove to be a unique opportunity for Briish breeders to secure fresh markets abroad.

Special terms and arrangements are being made for those who wish to attend the Congress from this country. The outward journey would be via London, Newhaven, Dieppe, Paris, Port Bou, and Barcelona, returning via Madrid, Burgos, Biarritz, Paris, Dieppe, to London. The special fares are as follows:—1st Class, £12 18s. 9d.; 2nd Class, £9 5s. 2d. (Sleeping berths extra, also the cost of transfer between stations in Paris.) The journey to Barcelona and on to Madrid must be taken by the party (of not less than 25) without a break, but the return journey can be made at will and be broken to see places of interest en route. Application for tickets and further particulars should be made to Mr. T. R. Robinson or Mrs. Rawson, at 3, Vincent Square, London, S.W.1.

It is to be hoped that this country will be adequately represented at the Congress, for delegates will be coming from 30 countries who have signified their intention of being officially represented. South America in particular will be well represented by prospective buyers. There is also some promise that a good market for high class poultry stock could be found in Spain itself.

Registers of Growers of Certified Immune Varieties of Potatoes in 1923.—During the past season, Inspectors of the Ministry of Agriculture have examined many fields of growing potatoes of varieties immune from wart disease, with a view to certification of the crops under the Wart Disease of Potatoes Order of 1923 as true to type and free from "rogues." A list of growers of these certified stocks has been prepared and copies may be obtained, price 1s., from the Ministry, which will also be happy to supply on application the names and addresses of growers of certified stocks of any particular variety, together with the numbers of the relative certificates. Growers are reminded that only " seed " from crops which have been so certified may be planted on land which is infected with wart disease.

The Board of Agriculture for Scotland has issued a similar register of Scottish growers with the acreages and kinds [illegible] potato crops certified, together with certificate numbers. Copies [illegible] be obtained from the Secretary, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh, price 2s. net, post free.

* * * * * *

REPLIES TO CORRESPONDENTS.

Period of Growth of Crops.—V.W. asks for information as to the average time in which various crops become available after dates of sowing.

Reply: It is almost impossible to give any categorical information on this subject. Much will depend on the variety sown as well as on climatic, soil and weather conditions. For instance, at Rothamsted Experimental Station, in 1922, two crops of Red Standard Wheat sown within five days of each other (on 24th October and 29th October, 1921) were carted respectively on 7th September and 26th September, 1922. Plumage Archer Barley in 1921 was carted in a day over five calendar months from sowing; in 1922 the same crop on the same field took practically six months from sowing to harvest.

Starch Equivalent and Albuminoids.—X.Y. asks for information.

Reply: The significance of these terms is explained in the introduction to the Ministry's Miscellaneous Publication No. 32 (*Rations for Live Stock*). In compounding rations, regard must be had to the proportion of digestible protein (albuminoids) to starch equivalent. This is explained, as regards the feeding of dairy cows, in Leaflet No. 388, and, as regards pigs, in Nos. II and III of a series of articles on Pig-Keeping in this *Journal*. (The articles referred to appeared in the October and November issues of last year.) In purchasing feeding stuffs, the simplest guide to money value is the starch equivalent. See the table published monthly in this *Journal*.

Pollination of Vegetable Marrow.—B.D. inquires as to this.

Reply: The Vegetable Marrow may safely be said to be normally insect-pollinated. Knuth (*Handbook of Flower Pollination*, vol. 2) does not expressly refer to the Vegetable Marrow, but mentions the honey-bee as frequently visiting the flowers of the Pumpkin, which belongs to the same genus as the Vegetable Marrow. On the general question of insect-pollination correspondent was referred to Lord Avebury's *British Wild Flowers considered in Relation to Insects*.

* * * * * *

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous.

Russell, Sir E. J. and others.—The Micro-Organisms of the Soil. [Rothamsted Monographs on Agricultural Science.] (195 pp.) London: Longmans, Green & Co., 1923, 7s. 6d. net. [63.115(02).]

Bornemann, F.—Kohlensäure und Pflanzenwachstum. 2te Auflage. (138 pp.) Berlin: Paul Parey, 1923. [58.11(04); 63.168(04).]

Wiest, E.—Agricultural Organisation in the United States. (640 pp.) Lexington: University of Kentucky, 1923. [35(73); 63(73).]

Bruttini, A. (International Institute of Agriculture).—Uses of Waste Materials: The Collection of Waste Materials and their Uses for Human and Animal Food, in Fertilisers and in Certain Industries, 1914-22. (387 pp.) London: P. S. King, 1923, 12s. [58.16(02); 63.16(02); 63.60432(02); 664.3(02).] Reviewed in the January issue of this *Journal*.

Field Crops.

Boas, F. und *Merkenschlager, F.*—Die Lupine als Objekt der Pflanzenforschung: Morphologie, Anatomie, Physiologie und Pathologie der gelben Lupine. (152 pp.) Berlin: Paul Parey, 1923. [63.33(*d*).]

Royal Agricultural Society of England.—Sowing Land Down to Grass. (6 pp.) London, 1923. [63.33(*a*).]

Robertson, G. S.—Phosphates and Improvement of Pasture. (9 pp.) Belfast: Ministry of Agriculture, 1923. [63.33-16.]

Rouest, L.—Le Soja et son Lait Végétal: Applications Agricoles et Industrielles. (161 pp.) Paris: Librairie des Sciences Agricoles, 1921, 10fr. [63.321.]

Midland Agricultural and Dairy College.—Report on Field Experiments with Potatoes carried out on the College Farm 1921-23: (*a*) Varieties, (*b*) Potash Manures, (*c*) Maximum Manuring, (*d*) Local *v.* Scotch Seed. (14 pp.) Sutton Bonington, Loughborough, 1923. [63.512(04).]

Horticulture.

Rockwell, F. F.—Gardening Under Glass. (307 pp.) New York Garden City: Doubleday, Page & Co., 1923, $3.50. [63.5-19.]

MacDonald, J.—Lawns, Links, and Sportsfields. (87 pp.) London: "Country Life" and George Newnes, 1923, 5s. [63.58(02).]

Plant Pests and Diseases.

Wardle, R. A. and *Buckle, P.*—The Principles of Insect Control. (306 pp.) Manchester: University Press; London: Longmans, Green & Co., 1923, 20s. [59.16(02); 63.29(02).]

Lefroy, H. M.—Manual of Entomology, with special reference to Economic Entomology. (547 pp.) London: Edward Arnold & Co., 1923, 35s. net. [59.16(02); 59.57(02).]

California Agricultural Experiment Station.—Bulletin 364: Fungicidal Dusts for the Control of Bunt. (40 pp.) Berkeley, 1923. [63.24.]

Livestock.

Benedict, F. G. and *Ritzman, E. G.*—Undernutrition in Steers: Its Relation to Metabolism, Digestion, and Subsequent Realimentation. (340 pp.) Washington: Carnegie Institution, 1923, $3.25. [612.394(02).]

Lynn, J. C.—Practice with Science in the Feeding of Farm Stock. (11 pp.) Hull: British Oil and Cake Mills, Ltd., 1923. [63.6043(04).]

Frateur, J. L.—The Age of the Horse according to the Teeth. Translation by *G. Mayall.* (65 pp. and 27 plates.) London: Baillière, Tindall & Cox, 1923, 5s. [63.61(02).]

Seale-Hayne Agricultural College.—Pamphlet 9:—Feeding Potatoes to Pigs. (7 pp.) Newton Abbot, 1923, 6d. [63.64 : 043.]

Mississippi Agricultural Experiment Station.—Bulletin 218:—Grazing and Feeding Trials with Hogs. (32 pp.) A. & M. College, Miss., 1923. [63.64 : 043.]

Dairying.

National Institute for Research in Dairying.—The Feeding of Dairy Cows by *J. Mackintosh.* (56 pp.) Reading, 1923, 1s. [63.711(04).]

U.S. Department of Agriculture.—Farmers' Bulletin 1342:—Dairy Barn Construction. (22 pp.) Washington, 1923. [63.6 : 69.]

U.S. Department of Agriculture.—Bulletin 1208:—Effect of Feeding Turnips on the Flavor and Odor of Milk. (7 pp.) Washington, 1923. [63.719.]

U.S. Department of Agriculture.—Bulletin 1190:—Effect of Feeding Green Alfalfa and Green Corn on Flavor and Odor of Milk. (12 pp.) Washington, 1923. [63.719.]

Wisconsin Agricultural Experiment Station.—Research Bulletin 57:—The Fishy Flavour in Butter. (51 pp.) Madison, 1923. [63.726.]

Seale-Hayne Agricultural College.—Pamphlet 10:—First Report on the Cost of Food in Milk Production in Devon and Cornwall during the five months November, 1922, to March, 1923. (10 pp.) Newton Abbot, 1923, 6d. [63.714(04).]

Poultry.

Gray, H.—Poultry Diseases and How to Prevent or Cure Them. (138 pp.) London: "Bazaar, Exchange and Mart," 1923, 2s. net. [619.5.]

U.S. Department of Agriculture.—Farmers' Bulletin 1363:—Natural and Artificial Incubation of Hens' Eggs. (18 pp.) Washington, 1923. [63.65(041).]

Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE,
By Metchim & Son, Princes Street, Westminster, S.W.1.

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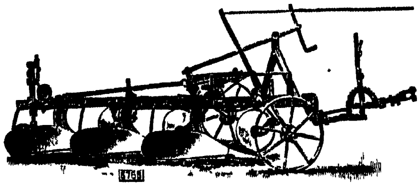

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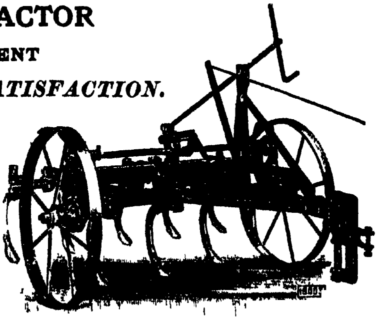

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THE JOURNAL
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MINISTRY OF AGRICULTURE
Vol. XXX. No. 12.

MARCH, 1924.

NOTES FOR THE MONTH.

Prime Minister's Statement to the Agricultural Advisory Committee.

THE Prime Minister, who was accompanied by Mr. Noel Buxton, Minister of Agriculture and Fisheries, and Mr. Walter R. Smith, Parliamentary Secretary, received at 10, Downing Street, on 1st February, the members of the Agricultural Advisory Committee for England and Wales.

The Prime Minister said that he had invited them to see him in order to assure them that the Government was exceedingly anxious to tackle the agricultural problem, and that he regarded the condition of the industry as a national concern. While the Government had to rule out any hope of Protection or subsidies of the kind suggested hitherto, it was most earnest in its desire to be of every possible assistance in other directions, and a special Committee of the Cabinet had been appointed to examine the problem. The Government would welcome advice and guidance from practical men who knew the difficulties and who would make suggestions for placing agriculture on a sound, scientific and businesslike footing.

He added that he felt that the great contribution that the Labour Government could make to the solution of the question was that they would relate the problem of the country to the problem of the town, and that if the agricultural problem was treated as merely a farmers' or a farm labourers' one, and not also treated as a town problem, no solution at all would be arrived at.

Short speeches were made in reply by Mr. R. R. Robbins, Mr. George Edwards, M.P., Lord Ailwyn, Sir Douglas Newton, M.P., Lord Clinton, Mr. McLaren and Mr. McCaig, all of whom expressed the appreciation of the Committee at the invitation to meet the Prime Minister and their desire to assist the Government in regard to any measures which could be taken for the benefit of agriculture.

* * * * * *

Agricultural Credit Societies.

THE Minister of Agriculture, the Right Hon. Noel Buxton, M.P., in reply to a question in the House of Commons, made the following statement:—

> "With the object of encouraging the formation of societies for the provision of short term loans to farmers under Part II of the Agricultural Credits Act, the Government have decided that advances to such societies should be made at bank rate varying—with a minimum of 4 per cent. Under present conditions this means a reduction of one per cent. in the rate of interest. I hope that farmers will realise the greatly increased advantages thereby offered under Part II of the Agricultural Credits Act."

This arrangement enables Agricultural Credit Societies formed under the Act to obtain advances from the Government at the current bank rate with a minimum of four per cent., and will enable the societies to lend the money at their disposal to their members at about one per cent. above bank rate.

A new leaflet has been prepared explaining the way in which credit societies can be formed and setting out the terms and conditions on which advances may be made to such societies. Copies can be obtained on application to The Secretary, Ministry of Agriculture, Whitehall Place, S.W.1.

* * * * * *

Loans to Agricultural Co-operative Societies.

THE Ministry of Agriculture is prepared to consider applications from agricultural co-operative societies for loans to enable them to develop forms of co-operation directed to the preparation and marketing of agricultural produce, such as bacon factories and milk depots. Provision will be made in the Estimates of the Ministry for the year 1924-5 for this purpose.

It will be remembered that the Departmental Committee on the Distribution and Prices of Agricultural Produce both in its various Interim Reports and in its Final Report strongly urged the need for State assistance to co-operative societies engaged in the sale, preparation or manufacture of farm products, by providing advances towards capital expenditure on buildings, land, plant or equipment. The Committee also recommended the appointment by the Minister of Agriculture of a small Standing Advisory Committee to consider the merits of applications for advances, the Committee being constituted so as to include in its membership those possessing not only an extensive knowledge of agricultural conditions, but also some experience in finance and commerce. The Minister proposes to adopt this recommendation, and it is hoped that it will be possible to announce the composition of the Committee at an early date.

The exact terms and conditions on which the advances are to be made will be settled after consultation with the proposed Advisory Committee, but in order to enable societies to consider the matter without delay the following provisional conditions are given as an indication of the lines on which loans will be made :—

(1) The Ministry of Agriculture will make loans to agricultural co-operative societies registered under the Industrial and Provident Societies Act to the extent of such funds as may be placed at its disposal. In order that a society may be eligible for a loan the society must have for its object such agricultural purpose as may be approved by the Ministry, and its capital must be subscribed mainly by agriculturists. The share capital paid up by the subscribers must be not less than 5s. per £1 share, and the rate of interest on the paid-up share capital must be limited to 5 per cent.

(2) The amount of the loan from the Ministry will not exceed, in the case of a new society, half the total capital considered by the Ministry to be necessary for the proper equipment and working of the society, nor the amount of share capital subscribed by the members of the society, whichever may be less. No loan will be granted until the Ministry is satisfied that the remaining capital required for the proper equipment and working of the society will be available.

(3) Loans will only be made to existing societies for the purpose of improvement or extension of premises and plant, and the loan will not in any case exceed half the sum estimated to be spent on the improvement or extension of premises and plant.

(4) In no case will the Ministry's loan exceed the sum of £10,000 to any one society.

(5) In the case of a newly-formed society the loan will be secured by a first debenture upon all the assets (including uncalled capital) of the society. In the case of an existing society, it will be secured if possible by a first charge on the premises and plant obtained or improved with its assistance. If such a first charge cannot be given the Ministry will require other satisfactory security.

(6) Interest will be charged on the loan at 5 per cent. per annum, and the loan will be repayable in instalments spread over a period not exceeding twenty years. Both interest and repayment of principal will be payable half-yearly. The first payment in respect of both interest and principal, may if the society so desire, be deferred for thirty months after the date when the loan is actually paid over by the Ministry, or, if the loan is made in

more than one instalment, thirty months after the date when the first instalment is paid. The first payment to the Ministry will be six months' interest on the whole amount of the loan and a proportion of the principal according to the period of the loan. When the first payment is deferred as suggested above, the repayment of the interest and of the principal will need to be adjusted so that the whole loan is repaid within a period not exceeding twenty years from the date when the loan is first made.

(7) The Ministry must reserve the right to require at any time immediate repayment of the principal of the loan and all outstanding interest, but there would be no intention to exercise this right so long as the Society was managed to the satisfaction of the Ministry. The Ministry will also have the right, if it so desires, to appoint, either temporarily or permanently, a representative on the Committee of Management of any society to which a loan is made.

(8) The society shall cause an audit of accounts to be made yearly, and a copy of the auditor's report and of the accounts shall be supplied to the Ministry. The books of the society shall be open to inspection by an officer of the Ministry at any time.

* * * * * *

Foot-and-Mouth Disease: Statement by the Minister.

THE Minister made a statement in the House of Commons on the 18th February on foot-and-mouth disease, from which the following extracts, dealing with the slaughter policy, and with research, are taken:—

The slaughter policy has been called into question and very naturally is a subject of great public interest. The Ministry has maintained the policy of eradication by the immediate slaughter of all infected animals. That policy was subjected to an exhaustive review two years ago by a Committee of which Mr. Pretyman, formerly Member for Chelmsford, was Chairman, and that Committee reported on the whole strongly in favour of the policy. Owing to the highly infective nature of the disease, isolation has, as a rule, been adopted only in a few cases of pedigree stock of very high value. Prior to 1922 the slaughter policy was very successful, and the average annual cost to the Exchequer for several years before 1922 was £9,000 a year. On the Continent, where the disease is endemic, isolation has been adopted of necessity—it would be impossible to stamp out foot-and-mouth disease in most Continental countries—and the annual loss, for instance, in France, is said to be about £5,000,000, and in Holland the amount lost is estimated at £2,500,000. Despite the heavy cost which the slaughter policy involved two years ago and the still greater cost now, it has never been in question whether the policy of mere isolation is not a failure compared with our policy. I have thought it over carefully, and in order to get a complete review of the situation I have asked Mr. Pretyman to preside over a Committee which will consist of some other gentlemen, as well as himself, who were members of the former Committee—the Parliamentary Secretary to the Ministry, Mr. H. German and Mr. Alexander Batchelor. I have asked them not merely to review the whole situation and the procedure adopted, but to go again into the comparative results and to state their opinion between one policy and the other.

It is very important to realise that this country, being an island, is capable of getting clear much more easily than other countries. Experience also shows that the results of slaughter have given satisfaction in the United States, Canada, Australia, New Zealand, Norway and Sweden. The United States had the disease and they eradicated it by slaughter at an expense of £1,500,000, since when they have been entirely free. In the same way, rinderpest has been completely stamped out in this country, as well as other diseases which we hardly hear spoken of now, but which some of us remember to have been very common.

If the disease were to become established and endemic here, as it almost certainly would become if isolation were adopted, among the subsidiary results would be the serious effect upon our export trade which we all know is a highly valuable item. Isolation not only requires too elaborate an organisation to be effective, but even in the few cases in which it has been adopted recently it has been very difficult to control the spread of the disease, and some cases have been freshly infected on premises on which isolation had taken place. The buildings on most farms are quite unsuitable for isolation, and you would require something much more elaborate to make the system a real success. Up to now we have the opinion of the majority of British agriculturists in favour of the slaughter policy, and during the present attack both the Council of Agriculture for England and Wales, and the Statutory Agricultural Advisory Committee, have approved of the policy of the Ministry. Another important consideration is that Great Britain has had extraordinary success with the policy in the past, and that the difficulty of isolation would be greater here than elsewhere because of the much greater stock of sheep in this country. Other countries have a much lower stock of sheep, and we have an unusual area of pasture on which sheep run together and on which it would be impossible to carry out any effective isolation.

One other subject remains on which I would like to say a few words, and that is the question of research. Research, to my mind, presents the only aspect of interest and satisfactory work on which we can dwell with pleasure in connection with animal disease. There is very magnificent work done at the laboratories of the Ministry, and at many laboratories, some of which the Ministry assists with money, up and down the country. The possibility of such a visitation recurring, to my mind, necessitates much greater attention being paid to research, both into the causes of the epidemic and also into the possible means of immunising stock against infection. The idea has prevailed hitherto that we were putting our foot upon the disease, and, therefore, research did not receive very serious attention in this country till a few years ago. Prior to 1920, I find, there was no particular investigation because of the extreme danger of spreading the disease. In 1912, a Commission was sent to India, with instructions to begin the investigation of the origin and means of transmission of the disease, but they found it was impossible to make any satisfactory progress with their studies because of the universal prevalence of the disease in a mild form, so that animals for experiment could not be found that were either free from the disease or not to some extent immune from it.

Following that, in 1920, a Committee was appointed, under the Chairmanship of Professor Muir, of Glasgow, which made investigations into the artificial cultivation of the virus and into the visibility of the microbe, the bacillus, but no success has as yet been met with in that respect. The Committee established a laboratory at Harwich, they asked the Admiralty for a disused warship, they anchored two lighters, on which the animals lived, alongside this ship, and for seven months they carried on research, but at the end of that time they came to the conclusion that it could not be profitably carried any further. The number of animals was too limited, there was great difficulty in maintaining a supply of virus, and another trouble has been that the virus, when brought from a distance, loses its virulence with great rapidity, and most variably and unexpectedly. The pathologists in charge failed to discover within the period any method of cultivating the virus, and the Committee concluded that they had better stop, unless it could be continued on a much larger scale, preferably on an island. They spent £18,000 on that piece of work.

For many years there has been continuous and organised investigation by the efficient veterinary staffs of countries where the disease prevails widely, such as France, Germany, Switzerland, and Holland, and in spite of all that, the greatest difficulties have been met, owing to the fact that the virus is ultra-microscopic. This is a general question of interest, not only in connection with foot-and-mouth disease, but scientists all over the civilised world are working at this matter of visibility or ultra-invisibility, and when that has been advanced, foot-and-mouth disease, with other diseases, will be dealt with with far greater ease. There is work being done all over the world on what is really the basis of research, but so far these investigations have not succeeded. They have not cultivated the organism, and they have not found a vaccine. Quite lately, a German investigator was said to have made a very great advance, and the German Government gave permission for him to discuss the matter with one of our representatives. One of our officials has been sent, and we are hoping for his report.

There are experiments being carried out under the Ministry's chief veterinary officer, and we are examining the possibility of further investigations. Sir Robert Sanders referred the question to the well-known scientist, Sir William Leishman, as to the proper sphere of inquiry, and I propose to appoint a Committee, consisting of both veterinarians and human pathologists, with instructions to frame a scheme of investigation, and then to allocate to each branch of it the particular individuals who are most suitable, the Committee to supervise and to co-ordinate the results. That will cost money, and we have obtained the consent of the Treasury for a sum sufficient to carry on that work for some years. We cannot anticipate that this very difficult inquiry will come to an end for a very long period. It might be several years before any adequate results were obtained. I think we may hope that such an exhaustive inquiry may lead to very valuable results, which have never been gained in this country up till now. I think that is all I had better say now. It seems to me that from this very sombre subject one very fine thing emerges, and that is the unremitting work done by those concerned with the outbreaks, and the untiring labours connected with the research which has already been carried out.

National Stud.

MR. LAMBERT asked the Minister of Agriculture in the House of Commons on 18th February what were the capital costs in buildings and other expenses incurred in the taking over of the national racing stud; whether such sums were paid out of borrowed money; what have been the financial results of Government racing during the past year; and whether it is intended to continue this pastime at the taxpayers' expense.

In reply, Mr. Buxton stated that the national stud was established in 1916, primarily on military considerations, as the result of the gift to the Government by Lord Wavertree of his valuable thoroughbred stud, together with all the live and dead stock on his Tully estate in Kildare. The owners' and tenants' interests were purchased for £47,625 by means of a Vote of Parliament. The stud is maintained as a breeding, and not a racing, establishment, and there is an accumulated trading profit up to 31st December, 1922, of £38,550. There is no reason to think that the trading account for last year will not, also, show a profit. It is intended to maintain the national stud, and, it is hoped, to the continued benefit of the taxpayer.

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Heavy Horse Breeding Grants.

IN reply to a question in the House of Commons on the 19th inst., the Minister of Agriculture stated that he had carefully reviewed the circumstances of Heavy Horse Societies in relation to the Ministry's Live Stock Improvement Scheme, and was satisfied that the withdrawal of grants to those societies in 1922 had discouraged co-operation among farmers in the hiring of stallions, and had otherwise proved detrimental to the heavy horse breeding industry; he had, therefore, decided to restore the grants so far as direct subsidy to a society is concerned.

* * * * * *

Agricultural Wages.

IN reply to a question in the House of Commons on 20th February as to the date when legislation would be introduced to give effect to the Prime Minister's promise with regard to the setting up of a wages board and legal minimum wage for agricultural workers, the Minister of Agriculture said that he was not yet in a position to state when it would be possible to introduce legislation to deal with the question of agricultural wages, but every effort was being made to press forward with this question, and he hoped that he would be able to submit his proposals to the House at an early date.

The Agricultural Index Number.

THERE was a further marked advance in the general level of prices of agricultural produce in January, the average increase over the corresponding month in the years 1911-13 being 61 per cent., compared with 56 per cent. in December. There has been a continuous rise since October, but the figure is still lower than at this time last year.

In the following table are shown the percentage increases monthly since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.	1924.
January ...	200	183	75	68	61
February ...	195	167	79	63	—
March ...	189	150	77	59	—
April ...	202	149	70	54	—
May ...	180	119	71	54	—
June ...	175	112	68	51	—
July ...	186	112	72	53	—
August ...	193	131	67	54	—
September	202	116	57	56	—
October ...	194	86	59	51	—
November	193	79	62	53	—
December	184	76	59	56	—

Although the advance in wheat prices which occurred during November and the first half of December was interrupted towards the close of the latter month, a recurrence of the rise in January caused a further slight advance in the index number. Oats also advanced further, while barley realised somewhat higher prices in January than in December, an unusual feature at this season. The index numbers for the three cereals are, on the whole, keeping very close together, and all show a decided advance since the opening of the cereal year.

The most prominent feature of the month of January was the rapid advance in potato prices. During the last two months of 1923 prices at the wholesale markets rose by nearly £1 per ton, while January prices averaged nearly £2 per ton more than those of December. Potatoes are now considerably more than twice their pre-war price, a striking contrast with the position in January of last year, when wholesale prices were practically at pre-war level. No marked shortage has been experienced in the markets, and the recent advance in prices is probably in part due to anticipation of and actual effects of the railway strike in relation to the much smaller crop of 1923. Potatoes are estimated to represent normally about one-twentieth of the total annual sales of produce off farms in this country, and two points out of this month's rise of five points in the general index number are thus accounted for by the increase in potato prices.

Fat cattle and sheep advanced in price in January, contrary to the usual fall after the Christmas trade, but pigs were cheaper, although the decline was relatively no greater than normally occurs between December and January. All classes of fat stock, however, and especially pigs, are cheaper than at this time last year, when both sheep and pigs were exceptionally dear.

So many markets are closed to store stock at present that average prices of dairy cows and stores are not thoroughly representative of trade throughout the country. The figures quoted in the table given below indicate, however, that store cattle and sheep are dearer, but that store pigs are cheaper, probably in sympathy with conditions in the trade for fat pigs.

Apart from these changes, there has been little noticeable alteration during the month. Poultry, after experiencing a dear Christmas trade, has relapsed to about the November level, 60 per cent. above the average pre-war prices. Eggs remain comparatively dear at 85 per cent. above the price in the corresponding month in 1911-1913, while dairy produce shows comparatively little change on the month; cheese is 1s. 6d. per cwt. cheaper, but this fall is less than normally occurs at this season, and the index number shows an advance of 5 points. No appreciable improvement in hay prices can be recorded.

The following table shows the average increases during recent months and in January, 1923, in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1923.					1924.
Commodity.	Jan.	Sept.	Oct.	Nov.	Dec.	Jan.
Wheat ...	33	19	20	22	33	34
Barley ...	20	30	25	25	27	34
Oats	43	30	25	24	30	38
Fat cattle ...	61	45	44	47	49	56
Fat sheep ...	103	72	76	77	72	87
Fat pigs ..	102	55	48	47	43	43
Dairy cows ...	74	52	61	57	—	51
Store cattle ...	36	27	27	25	—	35
Store sheep ...	105	109	99	88	—	91
Store pigs ...	171	95	82	75	—	62
Eggs... ...	86	75	92	92	86	85
Poultry ...	81	67	65	58	77	60
Milk	90	67	72	75	90	87
Butter ...	73	56	61	64	68	68
Cheese ...	85	74	76	78	71	76
Potatoes ...	—1*	75	62	80	91	129
Hay	43	32	7	—1*	0	—1*

* Decrease.

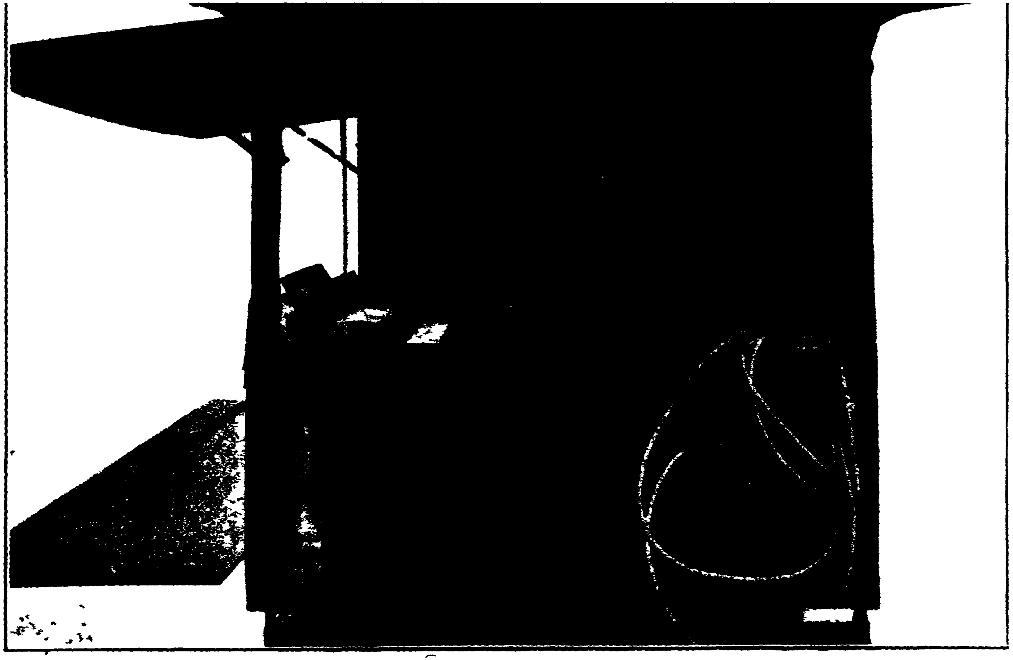

FIG. 1 —Interior view of the Farriery Van (p. 1091)

A Travelling Farriery Van.

AN interesting experiment is now being conducted in Oxfordshire by the County Agricultural Committee. Some time ago the Rural Industries Intelligence Bureau carried out a survey with regard to rural industries in the county of Oxford. As the result of the report of Mr. Elkington, the Secretary of the Bureau, who carried out the survey, it was decided that some attention should be devoted to assisting blacksmiths throughout the county, by demonstrating how their trade could be expanded in the direction of general metal and repair work, by the use of simple machinery.

With the sanction of the Treasury a sum of money has now been provided from the Development Fund, which has enabled the Ministry to purchase and equip a travelling van which will be available for loan to different counties, Oxford having been selected in the first instance. The van will be in charge of the Farriery Instructor attached to the County Agricultural Committee, who will tour from village to village with the object of affording instruction to as many blacksmiths as possible by means of the special machinery installed in the van. The photograph shows the interior of the van. It may be mentioned that the chassis is that of a 4-ton lorry, purchased at the Slough Depot, with a standard pattern War Office workshop body as used in the War. It has been specially equipped with an oxy-acetylene welding plant, emery grinding and drilling machines, lathe, work bench, and vices, and a serviceable outfit of small tools and accessories. Power for driving certain of the machines installed is supplied by a small 1½ B.H.P. oil engine. The equipment of the vehicle has been in the hands of the Rural Industries Bureau, and the actual fitting up of the workshop has been carried out by the Government Instructional Factory for disabled men at Cricklewood, whose services have been available through the courtesy of the Ministry of Labour.

By kind arrangement of the Manager of the factory, the van was inspected on 29th January by representatives of the Ministry of Agriculture, the War Office, the Home Office, Board of Trade, Development Commission, the National Master Farriers' and Blacksmiths' Association, the Bureau, and the Press. The Director of Agriculture for Oxfordshire and the county farriery instructor were also present. All expressed themselves as highly satisfied with the equipment of the van.

The van will start its tour in Oxfordshire at an early date.

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AGRICULTURAL POLICY OF THE GOVERNMENT.

IN his statement in the House of Commons on 12th February, the Prime Minister referred to agriculture as follows:—

We come to agriculture. In agriculture we have a subject of the most pressing national interest. I have not shared the views of the agriculturist who said the industry was on its last legs. There is plenty of evidence to show that is not the case. A great fault committed by those fellow-citizens of ours who are always telling us they are on the brink of ruin is that they always live from season to season. When a good season comes they say nothing about it. When a bad season comes all they do is to produce to their own minds and to us the figures of the bad season and try to convince us that that is a normal and average condition of the industry in which they are engaged. Far from it! There is not the least doubt about it that even now careful book-keeping on the part of large numbers of farmers does not exist, and one of the services now being given by the Ministry of Agriculture to the farming industry is to supply them with professional gentlemen who can tell them how to keep books and accounts with sufficient accuracy to enable them to see how their business goes from year to year. There are some other schemes that must receive immediate attention.

There is, for instance, the question of rating—not necessarily agricultural rating, but the whole question of rating. Government after Government has promised to deal with this subject, and I have not the least doubt has tried to deal with it, but has failed to do it. The Labour Government is going to make an attempt. The whole question of rating is due for revision, not for farmers, but for everybody. The Government proposes to bend its attention to this subject and hopes, with a fair amount of luck—before it will be time for it to leave these benches and either transfer to those opposite or go to the country—it will have produced its scheme for readjustment and reform. No interest in the country would benefit more from a rating based on scientific principles than the agriculturist, the farmer who is farming his land, and who is not going to be charged with rates for improvements upon it.

So far as we are concerned we shall not touch tariffs nor bounties. Both tariffs and bounties are wrong. They only help to encourage inefficiency. They induce the towns to regard agriculture as something that preys upon them. They cannot be confined to agriculture and agricultural produce alone. Bounties in particular, and also tariffs—but bounties in particular, must be attended by an oppressive control, for no Government in its senses would ever make large presents of public money to an industry and then say to that industry: "You can carry on your work in any way you like." Control of the most definite, detailed, and most oppressive kind must accompany any system of bounties given to farmers. I am perfectly certain that, under these circumstances, farmers would not agree to it.

What agriculture requires is a stimulus to fight its own battle. I was talking to an eminent agriculturist only the other day and a remark he made to me was this: "If we could get all our agriculturists to farm as efficiently as the 20 or 25 per cent. at the top there would be very little agricultural problem in this country." That is the spirit and the line upon which the Government propose to work, and, therefore, we select co-operation as the best means for aiding, developing, and stimulating the agricultural industry.

The Government propose to support, either by loans or by guarantees, co-operative enterprises controlled by the agricultural community, organised and directed mainly to deal with agricultural produce, the buying of the raw materials, seeds, manure, the buying of implements of cultivation, the supplying of markets, and all those processes necessary to make agriculture a paying and prosperous concern in this country. The Government feel perfectly convinced that all extraneous aids to agriculture are only likely to result in a further deterioration of the agricultural mind, and an increased tendency and process on the part of farmers to trust to the power of the State and their influence in Parliament to get doles from the public purse, instead of solving their own problems by applying their own energy. The organisation of farmers' co-operative enterprises by farmers working as a function of the community, founded, encouraged, extended by State credit is a form of individualism which the founders and the defenders of individualism would not know from Socialism.

In connection with the idea of stimulus, the Government propose to set up again the Wages Boards. In some parts we are informed wages are again falling below the 25s. a week minimum. How any farmer can imagine that he is going to get value from a labourer whose income in these times is under 25s. a week I do not understand. [An Hon. Member: "He does not!"] Well, if he does not, the stimulus to compel him to regard labour as the first charge on industry will enormously improve him as a farmer and increase the efficient cultivation of his land. There is nothing that is more uneconomical, even on bad land, than sweated labour, and by the re-establishment of Wages Boards, which will work in districts, we will create a stimulus which, instead of being more hampering to the farmer, will compel the farmer to use more efficient expedients than he has used hitherto in order to make good use of his labour and land. The whole point is this—and this is the general idea of the Government—that until we get the farming community stimulated to organise itself and to function as it has done, in Denmark, for instance, then nothing else is going to be of real and substantial benefit to the agricultural community of this country.

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CO-OPERATIVE LIVESTOCK MARKETING IN THE UNITED STATES.

Since the end of the War, great progress has been made in the United States by livestock producers in the development of co-operative agencies, known as "shipping associations," for the purpose of replacing the ordinary buyer in the business of forwarding livestock to market.

These co-operative associations were primarily brought into being in consequence of the operating margins of stock dealers being considered excessive. The first associations of the kind were formed as far back as 1872, but it was not until 1916, in the middle of the War, that the movement began to assume large proportions. At the present time, there are said to be as many as 3,800 of these "shipping associations" in the United States.

The early organisations of this kind were formed as part of what was known as the Granger movement, and were followed by associations such as the Goodlettsville Lamb Club—a co-operative agency which graded and pooled lambs and wool, and sold them by auction. When favourable bids were not secured, the club shipped its products to central markets. This club has continued to operate since 1877, and a number of similar clubs have been organised in recent years on the same lines. In 1908 a "shipping association" at Lichfield, Minnesota, was inaugurated, and proved to be the beginning of a wide development in the co-operative selling of livestock in that district.

The year 1916 saw a very rapid rise in the general price level in the United States, and stock producers experienced an unwillingness on the part of local buyers to follow the rising markets, and to give an adequate price for animals, and they, accordingly, fell back on organising co-operative machinery to replace them. This resulted in the formation of a large number of livestock shipping associations. The scope of these associations is small, since they do not attempt more than the assembling of livestock in car-loads at country points, and forwarding it to central markets. Moreover, they have adopted the principle of co-operation only to a small extent. There is usually no pooling either of produce or profits, all receipts, after the cost of transport and handling have been paid, going to the owners of the stock. What success has been achieved by these societies is due primarily to the fact that they have been able to work on a narrower margin than the ordinary buyer, and it is claimed that in this way they have succeeded in substantially reducing the costs of marketing and distribution

A more important co-operative movement in connection with livestock is the formation of commission agencies, the genesis of which may be roughly described as follows :—

During the nineteenth century, there was a gradual concentration of the meat packing industry in Chicago, and along with this development, Chicago became the central livestock market, and tended largely to govern prices in other markets. In a similar way, the large meat packing firms have come to dominate the packing industry, and to handle the bulk of the meat slaughtered at the principal markets.

Originally, the packers bought direct from the owners, or from country buyers. The practice gradually grew up, however, for expert salesmen to act on behalf of those who knew little of livestock values, and from this, the livestock commission business was developed. Commission merchants at each market are organised into fairly close associations or exchanges, and these exchanges, in the course of time, became powerful enough to exclude from the market all business except that which passed through the hands of recognised commission agents.

Attempts on the part of producers to organise co-operative selling agencies of their own, met with little success until 1916, largely on account of the strong opposition of the livestock exchanges. Since that year, however, co-operative commission associations have progressed very rapidly, and on 1st January, 1923, such agencies are stated to have been established in thirteen of the principal livestock markets in the United States.

An important example of a co-operative commission agency is afforded by the Farmers' Union Livestock Commission. It was started by the Nebraska Farmers' Union, and the plan was to operate a livestock selling agency on the South Omaha market, without capital stock, which would charge the prevailing commission rate, and at the end of each year would pay all profits to shippers in the form of a "patronage dividend." An application by this organisation to the South Omaha Exchange was, as might have been expected, rejected. But the Commission started business independently, and after operating for some months at a loss, it eventually secured a considerable amount of business. At the end of the first year, the Commission handled over 2,000 car-loads, during the second year over 5,000, and in 1921 the business had increased to 7,700 car-loads.

Following upon the success of this agency, the Nebraska Farmers' Union organised similar bodies elsewhere, and were responsible for setting up three livestock selling agencies organised as joint stock companies.

One of the most remarkable of the co-operative livestock organisations is that developed at St. Paul's. The Central Co-operative Commission Association established at this market differed from other ventures of a similar character, in being founded upon local livestock shipping associations. Over 200 livestock shipping associations had become members of the Central Association at the time it started selling operations in 1921. The growth of this organisation was remarkable. Starting in August, 1921, by December it had received over 4,000 car-loads, and had become the chief agency in the market. In August, 1922, its business had amounted to approximately 13,000 car-loads, and the value of the animals sold during the preceding year amounted to over 17,000,000 dollars. The Association's chief success was, however, in the great saving effected for shippers. Not only did it charge a rate of commission 25 per cent. lower than the other exchange firms, but it made large profits which were distributed amongst its members in the form of patronage dividends. The total savings in commission alone, including both the 25 per cent. lower rate and the surplus trading profits distributed as dividend for the year 1922, were stated to be as much as 60 per cent.

By reason of its prominent position in the St. Paul's Livestock Market, this association succeeded in securing during 1922 a measurable degree of stabilisation of livestock prices in this market. To quote Mr. Steen,* "In former years, St. Paul's quotations fluctuated more violently than did other markets, but beginning about the time the Central† reached the 25 per cent. stage the market lost many of its former wild antics. It was pushed up closer to Chicago hog prices than had been the case for years, and remained there all spring and summer, with the difference that its fluctuations were less violent. The net advantage to producers from this stabilisation is great; the heavy runs of livestock are nearly all accompanied by lower prices, while the market is usually rather bare when sharp advances occur."

It remains to consider how far the principle known in the United States as "orderly marketing" or "merchandising," has been applied to the sale of livestock. In this connection, the most important development has been in the organisation of the National Livestock Producers' Association, and its affiliated commission associations, under the auspices of the American Farm Bureau Federation.

The movement was initiated in 1920, when a National Livestock Conference was held in Chicago. The Conference recommended the appointment by the American Farm Bureau Federation of a Committee of Fifteen, to develop plans for the co-operative marketing of livestock. This committee produced a scheme which was approved by a National Conference of Livestock Organisations in Chicago, in November, 1921. based on the following points:—

1. The formation of co-operative commission associations at each of the principal terminal livestock markets, each with subsidiary "stocker and feeder companies": these associations to be based both on individual membership of producers, and on membership of shipping associations.
2. The general development of co-operative livestock shipping associations along lines approved by the chief farm organisations in each State.
3. The organisation of the National Livestock Producers' Association as an overhead supervising agency, charged with the duty of perfecting an orderly flow of livestock to market.

In other words, this committee recommended the federation of Commission Agencies for the purpose of securing orderly marketing and the stabilisation of market prices, on the lines which had proved so successful in other branches of co-operative marketing in the United States (see article in this *Journal* for January, 1924). The first efforts were directed towards the organisation of commission associations, and six of these were established in different livestock markets during 1922. In each case they developed rapidly until they became the chief agencies in their respective markets. All these commission agencies are organised according to a uniform plan. They are non-stock and non-profit associations. Membership fees are charged for each livestock shipping association, and the affiliation of a shipping association automatically makes each individual farmer a member of the commission association and the National Association, without additional fees. There is no contract, though it is assumed that no shipping agency would join it unless it expected to consign most or all of its stock to the commission association. The commission associations handle non-members' stock in the same way as members', except that, in such cases, no patronage dividends are paid. Each commission association has a subsidiary organisation which makes purchases of "stockers and feeders" on order, buying wherever it can to the best advantage. The commission association is governed by a board of seven or more directors which supervises its activities, while the National Association has a board of nine directors, to which is added a representative from each terminal association as it is organised, the headquarters of the National Association being in Chicago.

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* "Co-operative Marketing. The Golden Rule in Agriculture," by Herman Steen, from which most of the facts in this article have been drawn.

† *i.e.*—The Central Co-operative Commission Association.

Up to the present, the development under this National Association has obviously not proceeded far enough to bring about an effective control over the movement of livestock to market, but the important point is that it has formed an organisation on the now well-established principles of co-operative marketing in America, which, when developed on a larger scale, will give to producers greater powers of controlling the marketing of their produce, and preventing undue fluctuation in livestock prices. At the moment it is clear that producers are only taking the first steps in co-operative livestock marketing. There would seem, however, to be every reason to expect a rapid development of the movement on the lines laid down by the Committee of Fifteen.

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LUCERNE.

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LUCERNE or Alfalfa (*Medicago sativa* et spp.) is a native of south-west Asia, wild forms also occurring in China and Siberia. It has been recognised since ancient days as a valuable fodder plant, and is now grown for "green fodder" and hay in most parts of the world—in some countries on an extensive scale.

In 1885 the area under Lucerne in England and Wales was 13,954 acres, by 1894 it had increased to 20,000 acres, during the ten-year period, 1894-1904, the area rose to 55,700, and by 1913 it had further advanced to 57,278 acres, and in 1923 to 57,900 acres.

Lucerne is chiefly grown in the eastern, south-eastern and midland counties of England, the only western counties growing appreciable amounts being Gloucestershire, Wiltshire, Herefordshire, Shropshire and Glamorganshire in Wales, not one of these counties, however, contributing as much as 1,000 acres to the total area.

The restricted area on which Lucerne is grown in this country, although largely due to soil and climatic conditions, is probably also in part due to a lack of appreciation of the many and important uses to which the crop can be put.

Value as Green Fodder.—Perhaps the outstanding merit of Lucerne is that, given favourable conditions and proper care, it has the ability to remain productive over a greater number of years and to produce a larger bulk of nutritive fodder per annum than any forage plant in general use. Thus on leys in Sweden Lucerne has given an average of 15 tons of green fodder per annum over a six-year period, and in this country and elsewhere leys are frequently competent to remain fully productive for ten years or even longer.

An important advantage of Lucerne is its ability to remain productive under conditions of drought, in which respect it far surpasses red clover. Thus in a dry year the total yield from a Lucerne ley cut three times may be more than double that from a red clover ley, while in a wet year the red clover may give slightly the heavier crop.

Lucerne has long been recognised as a fodder of particularly high feeding value. Feeding experiments conducted for milk production at Wooster, Ohio, have shown that Lucerne appears to be a better appetizer than red clover, but if samples of hay of red clover and Lucerne are of equal quality they are about of equal value for milk production; the superiority of Lucerne over red clover appears to turn not so much on its undoubted higher protein content as upon the greater bulk that can be produced per acre over a number of years.*

An important point in favour of Lucerne is, of course, its general utility—serving alike for the production of hay, silage and soiling.

In recent times it has come to be regarded as an excellent feed for pigs, while it has long been recognised as an admirable feed for horses, Rodwell in 1842 advising every farmer who can grow Lucerne to devote an acre of the crop to every four horses.†

In this country the view is generally held that Lucerne is not suitable for pasturage—thus at the Ministry's farm at Methwold it has been found, no matter what precautions are taken, that there is grave risk of the animals becoming "bloated." It should be remarked, however, that Lucerne is largely used for grazing in the Argentine, and an interesting account is given by McGillivray of successful pasturage in North Canterbury, New Zealand, by sheep.‡

The beneficial effect of a good Lucerne stand on the subsequent fertility of the land is a further consideration not to be overlooked, and has been well shown by experiments conducted at Rothamsted and in North America and elsewhere.§

Varieties and Nationalities.—Lucerne as ordinarily understood in this country is the blue-flowered species (*Medicago sativa*) which is a tall (about 2½ feet), erect, many-branched perennial with a deeply-penetrating tap-root. The yellow-flowered species (*M. falcata*) has a more branched and spreading habit, a less deep-going and more spreading root system, does not as a rule set seed as freely as ordinary Lucerne, and, largely in consequence of this last defect, can at present hardly be regarded as an important commercial commodity. A number of varieties also occur which are hybrids, having originated from crosses between *M. sativa* and *M. falcata*.

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* See Hayden, C. C.: "Clover or Alfalfa for Milk Production," Ohio Agricultural Experimental Station, Bull. No. 327, 1918.

† Rodwell, J.: "On the Cultivation of Lucerne," Jour. Royal Agr. Soc., Eng., Vol. III, 1842, p. 239.

‡ Mc. Gillivray, R.: "Pasturing Lucerne." New Zealand Journal of Agriculture, Vol. XXII, 1921, p. 93.

§ See, *e.g.* Report for 1918–20: Rothamsted Experimental Station. See Buffum, B. G.: "Alfalfa as a Fertilizer," Wyoming Agri. Exp. Station, Bull. No. 43, 1900.

The varieties and nationalities have been extensively studied by Witte and others in Sweden, and by Oakley and Westover and others in America, and it is only necessary here briefly to refer to those which appear to be suitable for use in this country.*

Provence, Spanish, Italian and Hungarian.—Trials conducted over a seven-year period by Messrs. Sutton and Sons of Reading,† have shown Provence superior to Spanish and Italian as 100 is to 95.3 and 90.4 respectively; while at Aberystwyth Provence compared to Italian as 100 to 60. These trials confirm the view generally held that of the ordinary European nationalities of Lucerne grown in this country Provence is the most reliable.

Hungarian Lucerne has, however, done very well in Sweden, and is stated by Elofson to be the best of the ordinary types for use in that country, giving yields of 20 or 30 per cent. higher than French, Spanish or Italian. In view of the fact that so many Swedish varieties of oats succeed well in Britain it would seem therefore that Hungarian Lucerne deserves extended trial.

American and Turkestan.—These nationalities are largely grown in America and have been tried from time to time in this country. Messrs. Sutton's trials appear to indicate, however, that they are not at all well suited to our conditions.

Grimm.—This is the best known variety of the hybrid (often known as variegated) Lucernes. Extensive trials conducted in the States since 1905 have shown true Grimm to be one of the hardiest of Lucernes in so far as resistance to winter killing by frost is concerned, and it is now extensively grown in Minnesota, Montana, Idaho and the Dakotas.‡

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* For important details as to varieties and nationalities see the following papers :—

Witte, Hernfrid : "Blåluzernodling," Göteborg, 1912.

Witte, Hernfrid : "Amerikanska blåluzern stammar, Grimm och Cossack vid försök i Sverige," Sveriges Utsädesförenings Tidskrift, 1922, p. 267.

Elofson, A.: "Anbau und Pflege der Luzerne," Jahrbuch der deut. Land. Gesellschaft, Vol. 35, 1920, p. 1.

Oakley, R. A. and Westover, H. L.: "Commercial Varieties of Alfalfa," United States Department of Agriculture, Farmers' Bulletin No. 757, 1916.

† See Sutton's Farmers' Year Book and Graziers' Manual for 1921.

‡ For further particulars as to Grimm and other variegated Lucernes see the following papers :—

Brand, C. J.: "Grimm Alfalfa and its Utilization in the North-west," U.S. Department of Agriculture, Bureau of Plant Industry, Bull. No. 209, 1911.

Westgate, J. M.: "Variegated Alfalfa," U.S. Department of Agri., Bureau of Plant Industry, Bull. No. 169, 1910.

Oakley, R. A.: "The Seed Supply of the Nation," Separate from Year Book, U.S. Dept. of Agri., 1917, No. 757.

Witte, "Amerikanska........" 1922, *loc. cit.*

Recently, renewed attention has been given to the variegated Lucernes in Europe, and Witte states, as the result of trials conducted at Svalöf, that genuine Grimm is quite comparable with Hungarian at any rate in first and second year leys (the duration of his trials at the time of reporting), and that should it prove to be persistent it might be presumed to be suitable for those parts of Sweden where often only two cuts can be made. Witte's data show that Grimm has out-yielded Hungarian in gross yield from six cuts in two years in the proportion of 100 to 93, whilst Hungarian has out-yielded Grimm in the sum of the third cuts only for each year in the proportion of 100 to 78. It is very significant that in Sutton's trials above referred to, over a seven-year period Grimm has yielded as heavily as Provence. and to find that Provence has shown to the best advantage during the first three years, but that in the seventh year Grimm has given decidedly the heaviest yield.

An indication of the hardiness of Grimm in comparison with Provence has been obtained from the Aberystwyth trials. In the case of a trial of Lucerne sown in drills in 1921 certain drills were cut monthly during 1922, and for the five months May-September the gross yield of these five cuts given by Provence was twice as great as that given by Grimm. The same drills were again cut monthly for the five months April-August, in 1923 (second harvest year) when the yields were in favour of Grimm in the proportion of 100 to 61, thus showing that Grimm had resisted this severe treatment better than Provence to a remarkable degree

It would appear from the above facts that Grimm is a variety that should be further tested in this country particularly in districts where it is difficult to establish a long-duration Lucerne ley, and in cases when it is not desired or practicable to take more than two or three cuts in any one season.

Selection of Field.—To succeed well, Lucerne requires fertile conditions. The soil, and perhaps to a greater extent the subsoil, should be suitable. It does best on clayey or sandy loam of good depth—with a well-aerated subsoil. Lucerne can only be grown successfully on stiff clay if this is well drained.

Lucerne requires a fairly high proportion of lime in the soil, since it is a plant which appears to make greater demands on this substance than most other crops—consequently, lime, as such, is necessary to Lucerne, irrespective of its ameliorating influence on soil acidity and soil condition.

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* It is evident from investigations in progress at Aberystywth with various herbage plants that ability to withstand severe and oft-repeated cutting affords a valuable indication of a plant's ability to persist.

Particularly in regions of high rainfall fields with a sufficient slope to assist the carrying away of surface water should be selected for this crop, any approach to stagnant conditions being highly detrimental.

Warmth is essential, more particularly when the general conditions are not favourable. During the seeding year especially, Lucerne tends to burn during the late autumn and is at all times a sensitive plant when growth commences in the spring. Witte* recommends the selection of fields sloping towards the south, and they should be so situated as to be sheltered as far as possible from the prevailing winds. The necessity for shelter and at least a comparatively deep soil has been demonstrated by the trials at Aberystwyth. On exposed fields it was only possible to establish very poor stands and these burned badly in the autumn and again in the spring, not assuming a healthy green colour until the summer was far advanced. The importance of exercising care in the selection of a field needs to be emphasised, for this is a factor which may make the whole difference between success and failure, particularly to the man who desires to grow a small area only in a non-Lucerne district.

Preparation of the Soil.—Lucerne may follow almost any crop, while in parts of New Zealand excellent results have been obtained by sowing as a first crop on virgin land. A successful Essex practice is to sow in July (without a nurse crop) after a bare fallow.

The essence of soil preparation is to clean the land thoroughly, destroy all weed seedlings and provide a settled soil with a good surface tilth for the seed bed.

Manures and Inoculation.—Elofson† states that provided the situation is warm and sheltered, Lucerne can be grown successfully on soils naturally deficient in lime when adequate dressings of this substance have been applied. The first essential, therefore, on all non-calcareous soils is to attend to the liming of the field. The fact that an excellent stand of Lucerne (sown in spaced drills) has been obtained at Aberystwyth on a fairly sheltered corner which had been limed heavily the year previous to sowing, while only poor stands (sown broadcast, in narrow and in spaced drills) have been obtained in the case of trials sown without lime, is probably not without significance in this connection.

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* See Witte, "Blåluzernodling"... *loc. cit.*

† *loc. cit.*

There can be little doubt that on many soils a complete absence of a proper strain of nodule-forming bacterium constitutes an important limiting factor to successful Lucerne cultivation. Trials conducted by Wright in the West of Scotland (1905-1909),* using a culture provided by Dr. Hiltner, Munich,† gave the following results over a five-year period:—

Untreated Plot	100	= average per annum.
Nitrate of Soda Plot	123	= ,, ,, ,,
Inoculated Plot	130	= ,, ,, ,,

More recently, trials conducted by the Scottish Society for Research in Plant Breeding have also shown the benefits from inoculation in a very striking manner.‡

Trials conducted in America and in Sweden have also shown the benefits that may on occasion be derived by inoculation with artificial cultures, provided these are obtained from a reliable laboratory and used strictly in accordance with the instructions accompanying them.

A method of inoculation largely practised, and one which in many cases has given better results than artificial cultures, has been the spreading of soil taken from a field which has maintained a good Lucerne ley. The soil to be used should be obtained just before it is required and on a cloudy day; it must not be allowed to dry in transit; a quantity of about 500 lb. of soil per acre is recommended; and it should be harrowed in immediately after distribution.

Oakley and Westover state (1922) that in some recent experiments good results have been obtained by sowing equal quantities of soil and seed together. This method obviates the necessity of distributing large quantities of soil over a field, this being of course a somewhat costly operation.

In general farmers who propose to grow Lucerne for the first time in non-Lucerne districts are recommended to employ artificial cultures, but when a satisfactory first stand has been obtained re-inoculation from field to field by the soil method should thereafter become a regular practice.

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* See Wright, R. Patrick: "Experiment on the Cultivation of Lucerne in Scotland: Effects of Inoculation," The West of Scotland Agr. College, Bull. No. 53, 1910

† The Culture was mixed with dry sand and distributed over the surface of the soil.

‡ See Report 1923, p. 33-34.

It should not, however, be assumed that inoculation is always necessary, or that inoculation is alone sufficient to ensure a good crop of Lucerne. Thus, extensive trials conducted by the Ministry in 1920 and 1921 did not indicate marked benefits from inoculation, while Wright's trials previously referred to showed that nitrate of soda gave results but little less satisfactory than inoculation.

Trials conducted by Ward in New Zealand and by Arny and Thatcher at Minnesota, U.S.A., are of interest in this connection. The following comparative statement is based on data presented by these authors.

At Minnesota (*U.S.A.*)		*In Canterbury* (*N.Z.*)	
No treatment	100	No treatment	100
Soil from Lucerne Field alone	109	Soil from Lucerne Field alone	182
Soil plus lime	113	Soil plus superphosphate	324
Lime alone	108	Superphosphate alone	188

It will be noted that at Minnesota, inoculation alone and lime alone have had about equally good results, while in Canterbury the same has been true of inoculation alone and superphosphate alone, while at both centres the greatest benefits have been derived from the combination of the two treatments. It is thus evident that inoculation is not to be regarded as a self sufficient aid to productivity, but as an addition to the better known and more ordinary methods of liming and application of manures.*

Lucerne, like red clover, responds freely to farmyard manure, which is perhaps best applied to the crop immediately preceding a Lucerne ley. Thus in the case of manurial trials reported upon by the Harper Adams Agricultural College in 1912 the plot treated with farmyard manure (10 tons) had outyielded all combinations of artificials. An exhaustive series of trials conducted in Missouri, U.S.A., showed good results from farmyard manure in 86 per cent. of the cases where a satisfactory stand of Lucerne had been obtained.* At Saxmundham, farmyard manure has also given good results—but has not been responsible for such heavy yields as a combination of superphosphate and muriate of potash. On poor fields, nitrate of soda in small amount is recommended by Swedish investigators, as this helps the plants to establish themselves and assists them until the nodules have been developed; liquid manure applied before sowing is also recommended by Witte. At Saxmundham nitrate of soda has not justified itself on established leys. Dyer, however, conducting trials near Tonbridge (1897-1901) obtained excellent results by the addition of nitrate of soda to dressings containing phosphates and potash.† Nitrogenous manures should not be used on good land as they encourage the development of weeds, and especially of rough-stalked meadow grass and *Poa annua.*

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* The following papers have been referred to or are of special interest in connection with inoculation :—

Oakley, R. A. and Westover, H. Q. : "How to grow Lucerne," U.S. Dept. Agr., Farmers' Bull. No. 1283.

Arny, A. C. and Thatcher, R. W. : "The Effect of Different Methods of Inoculation on the Yield and Protein Content of Alfalfa and Sweet Clover," Jour. Am. Soc. Agron., Vol. 7, 1915, p. 172.

Arny, A. C. and McGinnis, F. W. : "Methods of Applying Inoculated Soil to the Seeds of Leguminous Crops," *ibid* Vol. 13, 1921, p. 289.

Ward, F. E. : "Some Recent Lucerne Experiments in Canterbury," New Zealand Jour. Agr., Vol. 24, 1922, p. 226.

The most essential manurial ingredient is usually phosphoric acid, which may be applied in the form of basic slag or of superphosphate, as may be convenient. Since Lucerne is usually removed from the field either as hay or green forage, potash should always be supplied. Fields left down for a number of years should receive from time to time top dressings of phosphoric and potassic manures. From trials conducted at two centres in East Suffolk it would appear that a dressing of 2 cwt. of superphosphate and 1 cwt. of muriate of potash may be regarded as an application which may be profitably employed,‡ this dressing having increased the average yield from 25 cwt. of hay (on the unmanured plot) to 68 cwt. per acre. over the period 1903-8. More recent trials in New South Wales have also shown the heaviest yields to be from top dressings of 1 cwt. of superphosphate and ½ cwt. of sulphate of potash, and it is concluded that about 1 cwt. of superphosphate per acre per annum is sufficient for the plant's needs after an initial dressing, and that potash generally enters into the fertiliser requirements of Lucerne.§

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* University of Missouri. Agri. Expt. Station, Bulletin No. 106.

† Dyer, Bernard : "On Lucerne" Trans. High, and Agr. Soc. of Scotland, page 5, Vol. XIV, 1922.

‡ See Report of East Suffolk Education Committee for 1913.

§ Little, G. G., Lucerne Top Dressing Experiments (1913-16) Agri. Gazette of New South Wales, XXIV, 1923, p. 37.

CULTIVATION OF TURNIPS, SWEDES, AND KOHL RABI.*

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Yield Per Acre.—In most of the northern and western counties a yield of 20 to 25 tons per acre is only a normal result of ordinary good farming: in such a crop the individual "bulbs" weigh about 2 lb. The average yield over the whole of England during the ten years ended 1922, however, is officially recorded as 12.1 tons—about half a crop. In the eastern and the inland southern counties, natural conditions make the production of heavy turnip crops comparatively difficult, and once or twice in every decade there is a partial failure in many localities.

Difficulties in Turnip Cultivation.—In districts with high summer temperature, low rainfall and little dew formation during the growing season, turnip cultivation is risky on both light and heavy soils. The main risks are the following:—

1. Owing to dry conditions at sowing time, it is difficult to secure a plant: the seed may germinate very slowly and irregularly and the "fly" may destroy successive sowings, the result being that the growing period left is too short for the production of a full crop.
2. Dry weather in the latter part of summer, especially after leafy growth in the earlier portion, may bring on an attack of mildew.
3. On soured and infected land the crop may be attacked by finger-and-toe disease.

Where conditions are too hot and dry for successful turnip cultivation and mangolds do not meet the purposes intended, the suitability of kohl rabi should be considered.

In the moist cool conditions of coastal and northern counties and high-lying western districts, bad germination, "fly" and mildew troubles are not commonly met with. Moreover, the crop may be sown comparatively early, and it continues to grow far into the winter. The main difficulties under these conditions, besides finger-and-toe, are the following:—

1. Hand hoeing and singling may clash with hay-making operations.

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* See "*Turnips, Swedes and Kohl Rabi for Stock Feeding,*" by J. R. Bond. This *Journal*, February, 1924.

2. Continuous wet weather in early summer may enable the weeds to survive the hoe till the crop is too far advanced for further attempts at cleaning, the result being a dirty fallow and a poor root crop.

3. Wet weather in autumn may cause difficulties in harvesting the crop.

With a crop so much influenced by weather conditions as is the turnip, there can be no recipe for certain success. Nevertheless, as observation of results in practice shows, the risks of failure and disease can be considerably reduced by good management. Although in dairying and perhaps in cattle rearing the maximum practicable acreage should be devoted to root crops, it is better to cultivate a small area thoroughly than to attempt a larger acreage than can be effectively managed.

Autumn Tillage.—Turnips do best on a tilth that has been deeply worked and aerated a considerable time before sowing; but their predominant requirement is a sufficient and regular supply of moisture. Summer rains are proverbially beneficial to this crop; they are, however, insufficient to supply all the moisture necessary for a full yield. There is indeed a poor prospect and great risk of failure if at the time of sowing the soil is dry and there is no moisture reserve in the subsoil.

Autumn ploughing facilitates the admission of the winter rains into the subsoil, which should be capable of retaining a portion and during the following summer allowing it to pass upwards for the use of the crop. For autumn work the common plough may be preferred to the digger, as the broken furrow turned by the latter is apt to run together and hinder both percolation and aeration. In either case, the use of the large skim coulter is commendable when ploughing stubbles that have not been cleaned.

Autumn cleaning is desirable, as it conduces to a better conservation of moisture in spring; but the limitations imposed by soil and weather conditions, and the demands of other necessary work in autumn, usually cause the cleaning of the land for turnips to be deferred till spring. In some cases better advantage might be taken of the workable condition in which stubbles are usually found immediately after corn cutting and before they have become hardened by subsequent drying.

On heavy soils the land should be ridged up in autumn and the ridges split back once or twice during the winter.

Preferably the weeds should first have been eradicated, but in any case—even where the crop is to be sown on the flat—the superior tilth obtainable by winter ridging is a valuable factor in root cultivation on heavy soils.

Winter or Spring Manuring.—Experiments have failed to show the absolute superiority of either winter or spring application of the yard manure. Well-rotted manure applied in the ridges immediately before sowing gives excellent—perhaps the best—results in good turnip districts, provided that care is taken to avoid long exposure and drying of the ridges or manure before the latter is covered in. Where only a light dressing of yard manure is available, it is probably best applied in the ridges. Heavy dressings of long manure applied late in spring are apt to make soil-conditions too open for success, especially in dry districts.

It is obvious that application of the manure in advance saves time and reduces the pressure of work at a busy season; it also allows of cultivation on the flat, where moisture conditions favour this method; and it permits ridge drilling without the necessity of splitting the ridges at sowing time. When the land is dry enough in February, this is a good month to apply and cover the manure, as it will be sufficiently decayed to allow of cleaning operations at the proper time.

Spring Cultivations.—Where the turnip break receives no attention whatever between the ploughing in autumn or winter and the preparation of the seed bed in May, the likelihood of success is diminished. If the land has not been winter ridged, it should be cross ploughed when in a fit condition during February or early March, the effect being to deepen the layer of mellow aerated soil and to prevent excessive loss of moisture from the subsoil. Generally this work is best performed with the digger breast; but the main consideration is the state of the soil at the time the operation is proposed. Whether the land is or is not cross ploughed, however, it should not be allowed to lie through the drying weather of spring without a protective layer of loose soil on the surface: when dry enough not to smear, it should be chain- or plank-harrowed. Land so treated will subsequently work down to a tilth more readily and be less liable to form harsh clods than it is when left untouched till the commencement of cleaning operations.

In the work of cleaning and tilth formation, the field should be dealt with in successive strips, so that any lumps of soil brought up may be broken by the following operation when they are in the right state of dryness to crumble—not allowed to dry through and form clods. On the stronger soils, the tilth is best secured by working from the top downwards in successive operations of increasing depth, rather than by first grubbing or ploughing-up the bottom soil and afterwards reducing the clods that form. The disc harrow is useful, but probably the greatest service is rendered by the spring-tooth harrow, which is also an excellent implement for bringing up the weeds. Very stiff soils that cannot be spring-cleaned otherwise than by "roasting in the clod" are difficult to prepare successfully for turnips, unless they have been autumn cleaned and winter ridged.

Ridge or Flat?—There is little experimental evidence on this point. Ridge cultivation is the rule in the districts that have the best yield records; and there is no doubt that roots may be earlier and better cleaned when sown on ridges. Also the harvesting of the crop may be effected with less injury to the land when the rows have been lightly moulded up after the last horse hoeing. When ridges have to be made, however, the rows must be spaced wider than is necessary in flat work; and more thorough preparation and deeper tillage is required to allow of ridging than is needed for sowing on the flat. It is generally accepted that the flat system is preferable under conditions of low summer rainfall. Observation in the dry season of 1921 did not, however, confirm the expectation that better brairds would be secured on the flat than on ridges, probably because the rolling given after drilling achieved better consolidation in the ridges.

A good compromise between the two methods may be obtained as follows: ridges are drawn up and allowed to settle and become moist in the middle. Just before sowing, a chain harrow is run along them to destroy annual weeds and to expose the moist soil, in which the turnip seed will immediately germinate. This method is of great assistance in dealing with a cloddy seed bed. The ridge plough (more so than the single-breast implement) is apt to gather the clods on to the top of the ridge, where they cover the fine earth required by the seed. If the seed be drilled among clods and a plant be obtained, the work of striking and singling is exceedingly difficult, the seedlings having long thin stems growing round the clods. Chain harrowing before drilling rolls the clods off the ridges.

Width of Rows.—The heaviest crops can be obtained by drilling in close rows. Crops drilled on ridges only 20 in. apart may be found in competitions. It is questionable, however, whether the additional labour and inconvenience involved in working such narrow rows is warranted by the increase in yield obtained. With special blades it is possible to hoe, without covering or injuring the seedlings, in rows narrower than those required where only the ordinary implement is used; but on heavy land, and generally where the land is not very clean at the time of sowing, the standard width of 27 in. should be adopted.

Time of Sowing.—The only safe guide in this matter is local experience. In good turnip districts swedes may be sown early in May, whereas in dry sunny localities crops sown at this time would be liable to contract mildew later in the season. Early sowing is advisable where conditions will permit its adoption, as the risk of "fly" is reduced and a heavier crop can be obtained. Too early sowing, however, involves the risk of the crop bolting, as it did in 1923. Purple tops sown very early are also liable to keep badly in winter. Early and mid-June are common times for sowing swedes in the midland and southern counties. Yellow turnips, being of quicker growth, are usually sown when the season is three or four weeks too far advanced for the expectation of good results with swedes. Soft turnips are of still quicker growth. Kohl rabi needs a longer growing season than swedes, being comparable with mangolds in the time of sowing. With root crops in general it is better to defer sowing with a view to cleaning the land properly than to sow by a certain date and have to depend on additional hoeing to keep down weeds.

Seed.—Turnip seed is not sold in grades, otherwise the farmer would be advised to purchase samples with the largest seeds, as these give the strongest plants and the heaviest crops. Steeping the seed in turpentine with a view to the prevention of "fly" does not impair the germination. In the Royal Agricultural College experiments, steeping for 6 days was found to have rather a favourable effect on the vitality of the seed.

Kinds and Varieties.—The special properties of kohl rabi are that it will germinate and grow on a tilth that is too harsh for swedes; it continues to grow during dry periods when turnips stagnate or take mildew; and it is comparatively immune to finger-and-toe. It is not readily injured by autumn frosts and its feeding properties are equal to those of swedes. Rabbits and pigeons are, however, very fond of it; and, unless it can be sown very early, it will yield considerably less in good turnip districts than a crop of swedes. Bearing transplanting well, it may be sown in March in a small seed bed, and afterwards set out in the field.

As regards the respective merits of swedes and yellow turnips, the former generally yield as many tons per acre and roots of higher feeding value and better keeping quality than yellows. The latter can grow on soil too dry for swedes and they can be sown later. Yellows and white turnips are probably most necessary in sheep farming, for use in autumn before swedes are sufficiently ripe for safe folding. Swedes, but not other kinds of turnip, may be transplanted—as is common practice in Germany, where the "fly" is so troublesome in field sowing.

The results of the innumerable field trials comparing varieties of swedes and of other kinds of turnip have not been of wide service. Methods of turnip cultivation vary, and climatic conditions are not the same in different districts. Each farmer should carry out his own trials, utilising as a basis his own experience and that gained by the local agricultural college or organiser in trials. As regards the two main groups of swede varieties—the purple tops and the greenish tops, the latter appear to be the harder-fleshed sorts and of better keeping quality, but requiring good conditions and early sowing. They are not, however, of any higher feeding value, and they may not be so suitable as purple tops for early use or for districts where late sowing is necessary. Eclipse, Goliath and Tipperary are good purple tops; Longkeeper, Empire and Caledonian are good bronze tops. Invincible is an outstandingly good yellow turnip.

After-Cultivations.—The seed-drill is usually equipped with rollers that consolidate the soil sufficiently for turnips, which do not demand such a solid seed-bed as mangolds. When between sowing and germination the top of the ridge or row becomes loose and open, the land roller should be applied. Rolling is also beneficial when, owing to looseness and dryness of soil, the seedlings remain too long in the "two-leaf" stage: the fear of injury to the plants by rolling at this stage is without good foundation.

The work of hand hoeing—a serious drawback to turnip cultivation—can be greatly forwarded by the assistance of proper mechanical equipment. Some drills may be fitted with a pair of trailing blades which pare away the weeds on each side of the line of plants. This device works best on low ridges. Special blades may fitted to horse hoes to allow of shallow hoeing close to the plants. Where considerable areas of roots are grown, the three-row steerage horse hoe should be adopted, extra care being taken to ensure that the drill rows are spaced at uniform and regular distances.

Deep horse-hoeing between turnip rows undoubtedly injures the crop, especially when it is half grown. Before the tops meet across the row spaces, the soil will be found to be full of root fibres, these being too near the surface to allow of more than superficial movement of the soil. The necessity for much and late hoeing can be avoided only by proper cleaning before the crop is drilled. Early hoeing to keep the soil surface in mulch form not only destroys weeds but helps to conserve moisture and promotes nitrification. When the tops begin to shade the soil, the liability of the land to become crusted ceases. Earthing-up the crop in July is a common practice in Lancashire and certain other counties. Perhaps its main advantage is that it prevents so much poaching of the land at lifting and carting. Whether it materially promotes the growth of the plants has not been tested experimentally, but undoubtedly the operation checks weeds. In this work the main precautions are to avoid leaving it too late, and not to throw up a high coating of soil that will cause the bulbs to send out fibres at such a level as will make it difficult to clean them.

Singling experiments have proved nothing, except that the crop yields about the same weight of roots per acre whether there are several small turnips per foot of drill or only a single large one. It is doubtful whether there is real advantage in leaving the plants closer than 10 in. apart in 24 in. drills Of greater importance than uniform spacing to a certain distance, is the date at which the singling is effected: delay in the first cleaning and thinning may do great harm. The weeds and surplus plants not only crowd the crop above ground but they take up moisture and available plant food, removing it from the crop plants when the late cleaning is effected. It would appear, from what may often be seen in practice, that greater encouragement should be given to the improvement of mechanical devices to reduce the hand labour of striking and singling.*

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* See *Turnip Thinning and Harvesting* (Trials of Machines). This *Journal*, February, 1923, p. 973.

Storage.—In the conservation of swedes in covered heaps, the main point to bear in mind is the fact that the bulb dies and decays if suffocated by lack of air. A narrow heap covered with waste hay held down with a thin layer of soil provides the requisite conditions for good keeping.

Finger-and-Toe.—The presence of the specific organism causing the disease is necessary before a crop can be attacked by finger-and-toe; but the degree of the pest's destructiveness is determined by conditions, of which two are known, viz. :—the presence or absence of acidity in the soil, and the susceptibility of the plant cultivated.

Finger-and-toe is encouraged by the temporary sourness caused by lack of aeration, such as occurs in wet places, or in heavy land ploughed too late or in wet condition, or on headlands that are unavoidably much trampled and afterwards forced into a tilth. It is well known that turnips following potatoes are little affected with this disease, owing probably to the thorough aeration the soil receives during the cultivation of the potato crop; and winter ridging and splitting reduce the ravages of the pest on heavy land. Light land, however, that may be thought not to lack aeration is often badly affected. In this case, and usually if not always in that of heavy soils, the fundamental cause of the trouble is deficiency of lime. The fact that liming checks finger-and-toe has been known for at least 90 years, but the knowledge is not so generally applied as its antiquity might suggest. Gas lime has been found to be of little value in this connection, but carbonate of lime has given results equal to those afforded by quicklime.

The quantity of lime necessary to neutralise soil acidity varies: in some cases a dressing of 2 tons per acre is insufficient and has little effect on the disease. In this matter the assistance of the Advisory Chemist for the district is valuable* At Cockle Park, in experiments on heavy soil, the lime dressings were most effective in the fourth and later years after their application. At Craibstone (Aberdeen) on light land, however, the benefit began to show in the second turnip crop. In this case, where successive yearly applications of lime were made until the soil showed no lime requirement, it was found that the amount of lime necessarily so added was nearly 6 tons of ground lime per acre on one plot and nearly 8 tons of carbonate of lime on the other. The results in 1922 (the plots having been under turnips every year since 1915) were as shown in the following summary compiled from tables in Professor Hendrick's report (*Trans. Highland and Agric. Soc.*, 1923):—

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* See Leaflet 279. *Technical Advice for Farmers.*

Treatment.	*Yield per acre.*	*No. of plants surviving per acre*	*No. of bulbs sound or slightly diseased.*	*No. of bulbs rotten or badly diseased.*
	Tons Cwt.		per cent.	per cent.
No lime	4 13	15,540	11·6	88·4
Ground lime ...	13 1	29,840	45·3	54·7
Carbonate of lime	13 2	31,140	60·9	39·1

No variety at present on the market has been proved to be immune to finger-and-toe; but the simple experiment of sowing several sorts on infected land will reveal considerable differences in their susceptibility. The Danish State Experimental Station at Herning has for some years been engaged in selecting Bangholm swedes cultivated on infected land with a view to the production of a highly resistant strain. In trials in North Wales and Derbyshire, this strain has been found to possess a higher degree of resistance than ordinary kinds. In Derbyshire, Tipperary and Longkeeper swedes, Purple-top disease-resister yellow turnip, and kohl rabi, have been found to be less susceptible to finger-and-toe than a number of other varioites included in the tests.*

Continuous Turnip Culture.—The effect of lengthening the rotation with a view to avoiding finger-and-toe disease is often nullified by the presence of charlock and other cruciferous weeds (which perpetuate the disease), and by the necessary application of yard manure to the land, the yard manure being infected by the consumption of diseased roots. For the prevention of the disease, rotation changes are less effective than the removal of the aggravating conditions.

The dairy farmer is often deterred from cultivating a useful proportion of arable land because of the fear of this disease. The root crop is what he specially desires; but he is not disposed to cultivate four or five times the acreage of less necessary crops in order to maintain a proper rotation. In districts favourable to mangolds, dairy farmers often grow this crop for years in succession on the same—their only—piece of arable land. It has been shown that, provided attention is given to the lime requirement of the soil, the same method is possible with turnips. Hendrick quotes a case where the same field has been under continuous turnip culture for nearly 30 years, and in 1922 the grower reported "excellent results . . . . . 30 tons per acre and free from disease." The reason for the practice on this farm is that only this field of 18 acres is suitable for turnips, the rest of the farm being very heavy land. Every year ground lime is applied at the rate of 10 cwt. per acre; an ordinary dressing of dung, about 12 tons per acre, is applied once in six years, but every year a good dressing of about 10 cwt. per acre of artificial manures is given. The soil was tested by Hendrick in 1918 and showed no "lime requirement" and no trace of sourness.

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* See *Varieties of Swedes Resistant to Finger-and-Toe.* This *Journal*, July, 1922, p. 362.

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AGRICULTURAL RESEARCH EXHIBITS AT THE BRITISH EMPIRE EXHIBITION.

THE main object of the agricultural research exhibits at the British Empire Exhibition is to depict by examples the application of research to various branches of agriculture. The exhibit will be divided into eight main groups so arranged as to tell a continuous story:—

Animal Breeding and Nutrition (including Dairying), Veterinary Science, Soils, Plant Breeding, Horticulture, Plant Pathology, Agricultural Machinery, Agricultural Economics.

Group I. Animal Breeding and Nutrition (including Dairying).—Fundamental principles on which the scientific breeding of all animals may be based are being established by breeding experiments with poultry and other small livestock at the Animal Breeding Research Institute, University of Edinburgh and at the Department of Genetics, University of Cambridge. The application of this will be shown by the Edinburgh Institute in an exhibit on "Sex Studies in Fowls" and by the latter on "Sex-linked inheritance in Poultry."

It is generally recognised that there is need for much improvement in the wool of British breeds of sheep to-day. Research work in this connection will be illustrated by an exhibit on "Wool improvement by hybridisation," from the Edinburgh Institute. Another side of the work conducted at that Institute —Sex determination and differentiation in domestic mammals— will be shown by an exhibit illustrating "Intersexuality of the Goat." In the same group the School of Agriculture, Cambridge, will illustrate its work on "Fertility and sterility in Domestic Animals (the cow, sow and rabbit)."

Following upon these breeding questions the Rowett Research Institute. Aberdeen, will deal with one of the main lines of feeding investigations—the mineral requirements of animals. Further, in the exhibit of the National Institute for Research in Dairying the idea of " Milk as a source of energy from the Sun " will be introduced to depict research on winter *versus* summer feeding of dairy cows. Within the province of the National Institute for Research in Dairying are included all questions relating to the production, handling and distribution of milk, and the manufacture of dairy produce. Several of these branches of work will be illustrated.

Group II. Veterinary Science.—Following the breeding and feeding of animals the next group will be devoted to some of the research work on the diseases to which these animals are liable and the methods of control. The Animal Diseases Research Association of Glasgow and the Ministry's Veterinary Laboratory will deal with such bacterial diseases as braxy, swine erysipelas, tuberculosis. glanders and dysentery, ultra-visible virus diseases, such as foot-and-mouth, swine fever and roup. The worm parasites of domesticated animals and the pathology and epizootiology of the diseases caused by them, such as fluke disease in sheep. gapes in poultry and pimply gut, will be illustrated in the Institute of Agricultural Helminthology exhibit.

Group III. Soils.—As a necessary introduction to the plant breeding and horticultural groups, Group III (arranged by the Rothamsted Experimental Station). will deal with the properties of the soil and the question of getting the land into good " heart " or " tilth," which, as every farmer and gardener knows, is essential if plants are to maintain a healthy growth and satisfactory yields are to be obtained.

Group IV. Plant Breeding.—Perhaps in no other branch of agricultural science can the immediate value of research be shown so well as in the case of investigations into plant breeding, for it requires no power of argument to demonstrate the gain, not only to the farmer or horticulturist, but to the nation, derived from the introduction of a new or improved plant. The Welsh Plant Breeding Station, which is primarily concerned with the improvement of herbage plants, will contribute specimens of perennial rye grass and tall oat grass to illustrate variations found within a species—the necessary preliminary work to the improvement of the species. Cereals will be dealt with by the Scottish Plant Breeding Station (Improvement of Oats by selection and hybridisation) and the Cambridge Plant Breeding Station (the methods used in the breeding of improved forms of wheat and also some of the new forms which are being " grown on " for distribution). The National Institute of Agricultural Botany will provide a Potato exhibit, alternating with exhibits on " Yield testing of cereals " and " Seed Testing " as conducted at the Official Seed Testing Station for England and Wales.

Group V. Horticulture.—This group deals with the " breeding " and improvement of fruit trees and the control of the diseases to which they and other horticultural crops are liable. " Pollination," a vital factor in obtaining good crops, is to be dealt with in the Royal Horticultural Society's exhibit, while another subject of great importance to commercial and amateur fruit growers, " The Control of the Fruit Tree through its roots " will be illustrated by " paradise " stocks (the root stocks raised from cuttings or layers) from East Malling Research Station, and by " free " and " crab " classes (raised from seed) from Long Ashton Research Station. The latter will also deal with the manuring of fruit trees, fruit bud formation and big bud and reversion of black currants. Adjoining will be a case containing preserved specimens of typical fruits in their natural characteristic colours, grown in England in 1923. The Ministry's Horticultural Division is arranging this exhibit and also one of a model allotment to show, on a scale of 1/12th natural size, the arrangement and cropping of an ordinary 10 rod allotment laid out as recommended by the Ministry. Some of the pests and diseases which attack horticultural crops are dealt with in the exhibit from the Cheshunt Experimental Research Station, which specialises in glasshouse-crop pests and diseases and their control.

Group VI. Plant Pathology.—The importance of extended and continuous research into the numerous pests—insect and fungus—which annually take such heavy toll of the farmer's and gardener's crops needs no emphasis. The exhibit from the Institute for Research into Plant Diseases, Rothamsted, will illustrate investigations being carried out there to combat these pests. The Ministry's Pathological Laboratory at Harpenden is arranging an exhibit in this group in conjunction with various advisory centres throughout the country. In addition, the Institute of Agricultural Helminthology is illustrating the effect of parasitic worms upon the growth of clover, wheat, and strawberries.

Group VII. Agricultural Machinery.—In the centre of the Ministry's gallery there will be a model illustrating an up-to-date power farm with various field operations in progress. Fuller details of this exhibit will appear in a later issue of the *Journal.*

Group VIII. Agricultural Economics.—No exhibit illustrative of agricultural research would be complete without reference to the book-keeping side of farming, consequently the School of Rural Economy, Oxford, has promised to illustrate, on broad lines, the costs of production and yields of various farm produce.

Fuller details of all these exhibits will be published in a Guide which will be on sale in the Ministry's Gallery in the British Government Pavilion, and, to supplement the Guide, qualified guide-lecturers will attend to explain the significance of the specimens and pictures at stated intervals daily from the 23rd April next, when it is hoped that H.M. the King will officially open the British Empire Exhibition, until October.

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THE COST OF GRAZING.

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THE English farmer is often and possibly rightly blamed for the fact that his farm books are made to reveal very little information, which may be of practical and economic value. Whilst the truth of this cannot altogether be denied, it must also be borne in mind that in the determination of farm costs things are not quite so simple as they might at first sight appear. The determination of the cost of grazing on any particular farm possibly illustrates these difficulties better than anything else.

If we wish to determine the cost of grazing permanent pasture things may be easy, but when the aftermath either of seeds or meadow hay is grazed, an estimate has to be made, and the correctness or otherwise of this estimate will seriously affect the figure finally arrived at. Again, if we charge up to grazing the rent, rates, manure bill, man and horse labour employed on the grassland, these can be settled more or less accurately, so that the determination of the acreage cost of grazing should really create very few difficulties. This determination, however, by itself is of very little value; what is wanted is the cost of grazing per unit of stock, and as the grassland may be grazed either by dairy cattle, feeding beasts, young stock, horses, sheep, pigs, or even poultry, the proper allocation of this cost amongst the various heads of stock will again necessitate our making another estimate, which will enable us to express the stock-carrying capacity of the land in terms of either sheep or cow equivalents. Evidently, therefore, if we wish to compare the relative costs of grazing on different farms, for the sake of comparison the various results must be placed on a comparable basis. For the sake of uniformity it is usually agreed that one-third of the full rent, rates and manure bill of the meadow shall be charged to the cost of grazing the fog; and that in apportioning the costs of pasturage amongst the various classes of stock we may regard—

1 calf as being equivalent to	2	sheep.
1 heifer or store beast as equivalent to ...	4·5	"
1 cow or fattening bullock as equivalent to ...	6	"
1 horse as equivalent to	6	"

Determination of Cost.—Making use of the methods outlined above, the following results were obtained during the year 1919, when the grazing of 976 acres on twelve different farms in Yorkshire was closely investigated. This grassland carried during the year:—403 cows, 100 feeding bullocks and heifers, 91 young stock, 40 working horses, 16 young horses, 426 sheep, 45 pigs and 130 head of poultry. This was the equivalent of 4.083 sheep or 680 cows, and the land therefore carried the equivalent of 1 cow to 1.43 acres.

TABLE I.

GRAZING ACCOUNT, 1919.

12 *Farms.* 976 *Acres.*

	£	*s.*	*d.*	*Stock Carried*	*Sheep equiv.*	£	*s.*	*d.*
Rent	1,225	11	8	403 Cows	2,418	1,987	19	3
Rates...	328	17	3	100 Bullocks and Heifers	500	410	8	4
Seed	36	9	7	91 Young Stock	364	298	15	8
Manure ...	890	16	3	40 Working Horses	240	197	0	0
Incidentals ...	370	1	8	16 Young Horses	80	65	13	4
Labour—				426 Sheep	426	319	13	6
(*a*) Man ...	334	9	4	45 Pigs	45	36	18	9
(*b*) Horse ...	168	7	3	130 Head of Poultry	10	8	4	2
	£3.354	13	0		4,083	£3,354	13	0

From such an account as that given in Table I it is easily possible to determine the cost per acre, per cow equivalent, or per sheep equivalent, and to compare the relative importance of each of the varying factors which go to make up that cost.

TABLE II.

SUMMARY OF COSTS OF GRAZING.

	Total cost.			Cost per acre.			Cost per sheep.			Cost per cow.			Per cent. cost.
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	
Rent	1,225	11	8	1	5	1	0	6	0	1	16	0	36·7
Rates	328	17	3	0	6	9	0	1	7	0	9	6	9·6
Seed	36	9	7	0	0	9	0	0	2	0	1	0	1·1
Manure ...	890	16	3	0	18	3	0	4	4½	1	6	4	26·7
Incidentals .	370	1	8	0	7	7	0	1	10	0	11	0	11·2
Labour—(*a*) Man	334	9	4	0	6	10	0	1	7½	0	9	7	9·6
(*b*) Horse	168	7	3	0	3	5	0	0	10	0	5	0	5·1
TOTAL ...	£3,354	13	0	£3	8	8	£0	16	5	£4	18	5	100·0

From Table II it will be seen that the cost of grazing amounted to (*a*) £3 8s. 8d. per acre; (*b*) 16s. 5d. per sheep per year; (*c*) £4 18s. 5d. per cow per year; and that the grassland in that year on those farms carried an equivalent of 1 cow to 1.48 acres. If we assume that the cows were out at grass for twenty-two weeks during the year, it would give us a figure of 4s. 6d. as the average cost of grazing per cow per week, a useful figure for the man who was joisting milch cows at that time. We may take five-sixths of this figure, or £4 2s. 1d. as the cost of grazing a heifer, which would give us 1s. 7d. per week during the whole year. Assuming the winter grazing to be, roughly speaking, one-fifth of the value of the summer grazing, we may charge £3 5s. 1d. for the summer grazing per heifer, and 17s. 0d. for the winter grazing per heifer, which would work out at 2s. 6d. per head per week during the summer, and 8d. per head per week in the winter.

Again, this cost of grazing amounted to 16s. 5d. per sheep equivalent per year, which would correspond to 3¾d. per sheep per week all the year round, or approximately 5½d. per sheep per week during the summer months, and from 1½d. to 2d. during the time they were running out in winter.

Manuring.—A more detailed examination of the manure bill for the pasture in 1919, showed that during that year 90 tons slag, 52 tons lime, 14 tons superphosphate, 4 tons sulphate of ammonia, and 239 loads of farmyard manure had been applied. If this can be taken as typical of other years it would allow for a dressing of the grazing land of—

3 loads of dung per acre every twelfth year.
7 cwt. „ slag „ „ „ fourth „
8 „ „ lime „ „ „ eighth „
1 „ „ superphosphate „ fourth „
½ „ „ sulphate of ammonia every sixth year.

This would suggest that the average Yorkshire farmer is beginning to realise the importance of the improvement of his grassland. The importance of such improvement can be realised when it is remembered that to-day the grassland farmer is in a much sounder financial position than his arable brother, and that, with very few exceptions, where money is being made to-day on the farm, it is being made on produce which walks to the market.

Labour.—From the details given in Table II it will be seen that the total labour bill amounted to 6s. 10d. per acre for man labour and 3s. 5d. per acre for horse labour, and that these constituted 9.6 and 5.1 per cent. respectively of the total costs. Evidently in grazing, labour is one of the minor expenses, and as will be pointed out later on, the increased wages paid on the farm since the appointment of the Wages Board in 1917 have, in consequence, had less effect in adding to the cost of grazing, than to that of any other farm crop.

TABLE III.

LABOUR COSTS PER ACRE OF PASTURE.

	Man.		Horse.		Total.
	No. of days.	Cost	No. of days.	Cost.	
		s. d.		s. d.	s. d.
Draining and Ditching	0·13	1 1	0·04	0 2	1 3
Trimming Hedges and Repairing Fences	0·33	2 7	0·10	0 6½	3 1½
Applying Artificials	0·05	0 5	0·05	0 5	0 10
" F.Y. Manure	0·04	0 4	0·04	0 2½	0 6½
" Liquid Manure	0·05	0 4½	0·05	0 3½	0 8
Cutting Thistles	0·11	0 10½	0·05	0 3½	1 2
Chain Harrowing	0·08	0 6½	0·14	0 9½	1 4
Rolling	0·07	0 7½	0·10	0 8½	1 4
Total	0·86	6 10	0·57	3 5	10 3

In Table III are summarised the details of the labour employed on the pasture during the year referred to, from which it will be seen that it amounted annually to approximately 1 full day's work per acre for a man, and one-half a full day's work for a horse, at a total cost of 10s. 3d. per acre. The upkeep of the fences, draining, and cutting of thistles accounted for 54 per cent. of the total cost, whilst chain harrowing and rolling accounted for 26 per cent., the remaining labour being taken up almost entirely with the application of artificials, farmyard

TABLE IV.

YEARLY VARIATIONS IN THE COST OF GRAZING PER ACRE.

No. of Farms...	5	5	6	7	8	12	20	25	34
Year	1914	1915	1916	1917	1918	1919	1920	1921	1922
Rent	£1 4 0	£1 4 2	£1 4 6	£1 4 8	£1 5 2	£1 5 1	£1 4 1	£1 5 2	£1 8 5
Rates	0 3 6	0 3 10	0 4 2	0 4 9	0 5 6	0 6 9	0 7 1	0 6 10	0 8 1
Seed	...	...	...	...	...	0 0 9	0 0 11	0 1 7	0 0 1
Manure	0 4 3	0 3 9	0 8 8	0 7 7	0 13 10	0 18 3	0 10 1	0 6 1	0 3 9
Incidentals	0 1 2	0 1 6	0 3 9	0 5 6	0 6 8	0 7 7	0 8 0	0 9 4	0 10 8
Labour (*a*) Man	0 3 2	0 3 8	0 4 2	0 5 2	0 6 3	0 6 10	0 7 11	0 9 0	0 5 5
,, (*b*) Horse	0 1 8	0 2 6	0 2 10	0 3 0	0 3 3	0 3 5	0 3 4	0 3 5	0 2 11
Total Cost	1 18 0	1 19 5	2 8 1	2 10 8	3 0 8	3 8 8	3 1 5	3 2 3	2 19 4
No. of cow equivalent carried per acre	1·38	1·52	1·47	1·49	1·52	1·43	1·63	1·46	1·46
Cost per cow equivalent ..	£2 13 0	£3 0 6	£3 10 8	£3 15 4	£4 12 6	£4 18 5	£5 0 1	£4 12 6	£4 6 0
Cost per cow per week when at grass	0 2 5	0 2 9	0 3 2	0 3 5	0 4 2	0 4 6	0 4 7	0 4 2	0 3 11

manure and liquid manure. This average figure of approximately one day's man labour per acre has been confirmed by the average records of each successive year.

Yearly Variations.—It will be seen from the details given in Table IV that the cost of grazing, which in 1914 was approximately 2s. 5d. per cow per week, reached its maximum in the summer of 1920, when it amounted to 4s. 7d. and has since fallen gradually, though in 1922 it still stood at 3s. 11d. per head per week, approximately 62 per cent. above pre-war level.

The number of farms is not uniform, and these figures are not therefore altogether comparable, but it will be seen that while the average rent of the land has remained practically stationary, the rates have steadily mounted up, until in 1922 they amounted to nearly two and a half times their pre-war figure. There is no doubt that when allowance is made for the recent reduction in the rates on agricultural land, they will be found to have reached their maximum in the year 1922-23.

The manure bill per acre is seen to have reached its maximum in the year 1919, and to have steadily fallen since. The abnormally high figure in 1919 is in all probability due to two things: (1) to the fact that the prices of the artificials usually applied to grassland were at that time at their highest, and (2) to the fact that the twelve farms included in the year 1919, were all doing their grassland well, possibly better than usual.

Incidental Expenses.—The increase in the Incidental Expenses, corresponding to what may be called the non-productive charges such as tradesmen's bills, upkeep of fences and repairs to implements, which are at their minimum on grassland, and reach their maximum on arable crops like potatoes, is significant of the burden which the farmer at the present time is having to carry. There is no doubt that a crying need of agriculture to-day, is a reduction in the cost of production, whether of grazing or of any other farm crops, and possibly nowhere is it more needed that in the cost of various tradesmen's bills which the farmer has to meet. The following comparative costs of a few of these items extracted from the books of one particular farm are certainly significant:—

	1916.	1922.
	£	£
Wage Bill	2,217	5,626
Coal ,, ...	84	252
Fuel ,, ...	53	146
Blacksmith's and Implement Repairs	48	248
Shoeing Bill	20	78
Saddler's ,, ...	26	68

The whole farm has to bear the burden of these charges, and although the grassland bears only a relatively small proportion of these, yet, in 1922, they corresponded to a charge of 8d. per week for the grazing of each individual cow.

Labour.—It has already been pointed out that each acre of grassland absorbs approximately one full day's work for a man, and rather more than one-half of a day's work for a horse per year. This means that to all intents and purposes, the yearly variations in the cost of the man labour per acre of grazing, approximately correspond to the yearly variations in the daily wage of the men employed on the farm, which reached its maximum in the year 1921.

Again, the yearly variation in the cost of horse labour per acre of grazing will approximately correspond to half the cost of horse labour per working day.

Comparative Costs on Varying Farms.—For the year 1922-23 the average acreage cost of grazing amounted to £2 19s. 4d., and the average cost per cow equivalent to £4 6s. 0d. per year (or 3s. 11d. per head per week whilst the cows were at grass), but very varying results have been obtained on the different farms on which the cost of grazing has been investigated. The acreage costs varied between the extreme limits of £1 14s. 7d. and £8 4s. 4d. The extreme variations in the stocking can be seen from the fact that on the most heavily stocked farm each cow equivalent had the grazing of 0.7 acres, and on the least heavily stocked farm each cow had the grazing of 3.4 acres, while the actual cost of grazing per cow equivalent varied from £2 2s. 6d. per cow per year (approximately 2s. per cow per week when at grass), to £9 10s. 6d. per cow per year (approximately 8s. 6d. per cow per week when at grass).

In an article of this description it is obviously impossible to give the varying cost on each individual farm, yet it may be interesting to show some of the variations, and if possible to trace down the factors responsible for them. Evidently what is to be aimed at, if the most is to be made of the land, is to increase its stock-carrying capacity as far as possible at the minimum cost, and the most successful grassland farmer will be he who is grazing land with a high stock-carrying capacity at a low acreage cost.

It does not necessarily follow from this that the cheapest and lowest rented land is always the best, but the rent should be theoretically proportional to the inherent fertility of the soil, other factors such as nearness to markets, etc., being taken into account.

(1) *High Costs of Grazing.*—A high acreage cost may be due to one or more things. (*a*) The *rent*, and consequently the *rates*, may be heavier than the farm can reasonably be expected to carry. At the present time this is undoubtedly the case with a very large number of smallholdings, though as far as we have seen these rents rarely if ever give an adequate economic return for the money invested in enclosing, fencing and draining the land, and putting up the necessary house and buildings.

H.W.C. is a smallholding of 16 acres of grassland on the outskirts of one of the industrial towns in Yorkshire. The rent charged corresponds to less than 2 per cent. of the landlord's capital actually invested in the holding. It is good grass, well managed, heavily stocked, and treated on thoroughly orthodox lines, but killed by high rents and high rates, amounting to no less than £5 12s. per acre, and constituting 68 per cent. of the total cost. Had this holding been double the size, the capital outlay for buildings and housing accommodation for the stock would have been very much smaller in proportion.

(*b*) The land may be heavily burdened by being made to carry too high a proportion of the *non-productive charges* to which reference has been made.

The grassland on farm C.W.L. is heavily stocked and has been got into good condition. The rent and rates are both normal, but from an economic point of view the farm is being killed by its high standing charges. A casual observer going round the farm would be struck by its general neatness and good condition, the fences, roads, gates and doors appealing to the eye—though they have left their records in the balance sheet!

(2) *Understocking.*—The actual cost of grazing per head of stock will be determined by the acreage cost of grazing and the number of stock per acre which the grassland carries. Particularly in recent years, a large number of cases have been met with where the cost per head of stock has been too high owing to the fact that the grassland has not been carrying the stock it could and should be made to carry.

(*a*) It may have been deliberately understocked, either on account of shortage of capital, or because the holder hesitated on a falling market to invest heavily in store stock.

(*b*) The understocking may have been due to the fact that the grassland needed improvement either by way of draining, liming or manurial treatment.

The grassland on farms H.N.O. and H.C.B. is at the present time in quite good condition: both have kept their acreage costs as low as possible compatible with efficiency, but both last year deliberately reduced the head of stock that they normally carry. H.N.O. usually runs from 25 to 30 cows, and in addition fattens some 50 to 60 Irish bullocks or heifers on grass. In 1921-22 he was heavily caught with the falling market, and in 1922-23 cut down his purchases of Irish store cattle and failed to make any use whatever of his surplus grass. H.C.B. used to run about the same number of milk cows, but being in a district in the North Riding where milk prices have been utterly inadequate, he has reduced his stock of cows, but has not wasted his surplus grass. Much of the grass, which has been improved immensely, was meadowed. On some, sheep together with Irish cattle were joisted, and hay grown on the meadow which had previously been grazed was sold to the owners of the joisted stock to be consumed on the land; whilst an additional sixty-seven tons of hay were available for sale for consumption off the farm. This man covered himself economically by reducing the number of his own stock, but made the best possible use of his surplus grass, with the result that the acreage costs of grazing, and his cost per unit of stock grazed were both low.

(3) *Improvements.*—There is no doubt that a great deal of the grassland throughout the country, and particularly in the West Riding of Yorkshire, is not carrying the stock it could were it properly treated. This is especially the case on the coal measure and millstone grit soils naturally deficient in lime, which through their proximity to the industrial towns have been still further depleted in this respect by means of the acid nature of the rain. In other districts lack of drainage is the determining feature. In some of the latter cases this factor is under the control of the man who is farming the land, in others unfortunately it may be beyond his control.

In the case of farm C.N.D., for example, this latter holds good; his land, forty miles from the sea as the crow flies, is sixteen feet above sea level. It is well drained as far as he is concerned, and the dykes and drains are kept scrupulously clean, but the outlet of his drains has frequently been seen to be below the level of the water in the Commissioners' drains. This man has drained his land, limed it and slagged it, and improved it up to the hilt, as far as he is concerned, but the determining factor in the fertility of his land and its stock-carrying capacity is the regularity or otherwise of the Commissioners' pumping station a mile lower down.

On D.F.O.'s land, the determining factor again has been drainage, but a factor this time under his control. This land is a very heavy clay, which had been drained years ago, but when this man took over the farm in 1917 it was in practically a derelict condition. Most of the drains were blocked, none of the dykes cleaned out and the land thoroughly waterlogged. During the first year he tackled the dykes; most of the drains are now running; surface cuts or gripes have been made; the worst of the land has been limed, and much of it slagged and sheep run on the higher parts of the farm. The stock-carrying capacity has increased by more than fifty per cent., but it will be another two years at least before the land is got back into its proper condition, and able to carry all the stock that it should.

The case of J.H.S. is again interesting. The farm is on low-rented poor land at the edge of the coal measure soils, and little or no attempt has up to now been made to improve it. With its low rent and low rates, no outlay on farmyard manure, artificials and lime, and small expenditure on labour, the acreage cost is by far the lowest we have hitherto met with, but the fact that it is carrying very little stock, and that they are doing badly on it, makes this apparently cheap land really dear. It is capable of improvement and would pay for improvement, but until something more is put into it, it will remain dear at the low rent which is at present being paid.

In contrast with this is the case of P.O.H., whose land stands on the Millstone Grit more than a thousand feet above sea level, most of it little more than moorland a few years ago. Originally sour, all the land is limed every fifth year. Originally more poverty stricken than that of J.H.S. it has been well dressed with the manure from well-fed cows, supplemented with judicious application of phosphates. At the present time this farm of 120 acres, ninety per cent. of which is grass, is carrying sixty-four cows, a hundred pigs and nearly two hundred head of poultry. While the acreage cost of the grazing is more than double that of J.H.S. its cost per unit of stock is 18 per cent. lower, the milk yield of his cows 38 per cent. higher, and the net returns from his farm *three and a half times as great.*

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ARTIFICIAL DRYING OF CROPS.

DURING the past year the Ministry commenced an investigation into the artificial drying of crops in the stack. The system is an old one, and has had considerable popularity from time to time, and has never lacked advocates; but against the instances of the successful use of the method there have been many more instances of failure. Nor have the advocates of the system spoken with one voice; some variant has been claimed as the key to success. but, unfortunately, the key never seemed to open every lock.

The successes and failures are, broadly speaking, explicable. Much depends upon the season: continued wet or a long dry spell is a condition which must be taken into account whether the crop is in the stack or in the field. Crops differ widely in texture and in the way in which they pack in the stack; meadow hay is a very different substance from clover hay: wheat, barley, oats, peas, all have marked characteristics. A single recipe is prima facie unlikely to be successful.

The first task clearly was to survey the field, to discover what was being done in actual practice by those who were satisfied with the method, and to fill in gaps by arranging for experiments with crops other than those already being treated. Observations were eventually taken on 21 stacks made up as follows:—

Meadow grass 3, red clover 3, white clover 1, clover and meadow grass 1, rye grass and red clover 1, rye and tares 2. Barley 4, oats 2. Peas 2, beans 1 and lucerne 1.

In its simplest terms the problem of artificial drying consists in the removal of surplus moisture and the control of tem-

FIG. 1.—A 'Sirocco' Fan drying a Barley Stack

FIG. 2.—A "Cyclone" Fan drying two stacks of Rye and Tares

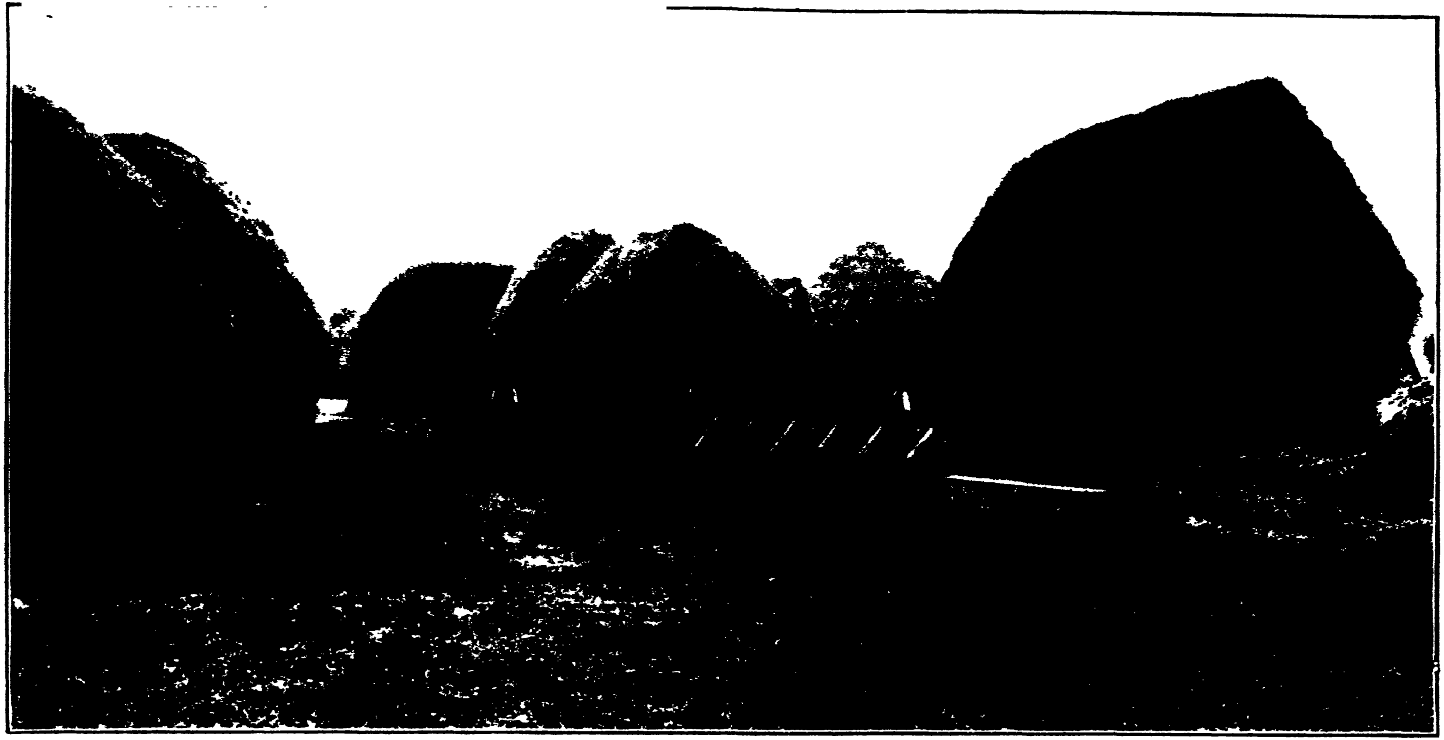

FIG. 3.—General view of Stack-yard, showing the form of Centre Chamber and Duct used.

peratures; actually it is not so simple as that, because, for example, the chemical and physical changes which are set up may affect the quality of the crop, and the condensation of moisture on the exterior of the stack, combined with heat, may produce conditions favourable to mould. However, if only surplus moisture can be removed quickly enough and the temperature kept below a point at which it would do harm, the problem is solved. This is in brief the argument for forcing a current of air through a stack by means of a fan driven at high speed by a motor.

Suppose we are set the problem of reducing freshly cut grass with a moisture content of, say, 70 per cent. to hay with a moisture content of 16 per cent. We do not propose to employ the usual process in the field—the weather is unfavourable. We know that a stack made of this crop with such a high moisture content (or indeed a very much smaller moisture content) will heat, and if the temperature is not controlled the crop will spoil and possibly the stack will fire. A current of air passing through the stack will not only remove moisture, but it will reduce the temperature by bringing cold external air into contact with the hot interior. The expulsion of the moisture which we do not want in our final product eventually removes the cause of heat as well.

This is the theory, but while we have been passing the air through the stack a number of other events may have occurred. The surrounding air may be damp and cold; it may not take up moisture sufficiently quickly when driven through the stack. Consequently, under such conditions the system will not be efficient.

It is not proposed now to describe in detail the methods adopted in drying the stacks under observation. There were certain general features common to all which will give sufficient indication of the system.

Before the crop was cut a central chamber and duct were constructed, and the stack was afterwards built in such a manner that, as far as possible, an equal resistance to the passage of air was offered around each part of the central chamber. The inlet duct constituted the channel by way of which the air delivered by the fan passed into the central chamber and ultimately through the stack into the open air.

Observations were taken from the time the crop was cut until the stack was dry enough to prevent further heating. The number of hours during which blowing was continued varied according to the nature and condition of the crop, size of central chamber in relation to volume of stack, and the fan and power available.

With this method corn, bean and pea stacks were treated successfully. Two pea stacks in particular were dried very rapidly, and the peas were amongst the earliest on the market. A good price was obtained for these as they were of exceptionally good colour and free from wrinkles. In addition the whole of the pea straw was made available for fodder purposes. A case occurred where a barley crop was at first abandoned owing to its sodden condition and the inability to harvest it by ordinary means. With the artificial drying system, however, the crop was dried and a feeding sample of barley obtained.

The treatment of hay was not uniformly successful, chiefly owing to the growth of mould on any parts of the stacks where surface moisture had not been entirely removed. The close texture of hay added to the difficulty of removing moisture.

The experiments have afforded a great deal of information and have suggested lines of laboratory work which have been carried out with successful results. Until experiments with a modified system have been successfully tested in the field, however, no really valuable advice can be given to those who are anxious to make a trial of artificial drying. It certainly seems as though the simplest form of forced draught will dry peas successfully; but much still requires to be known, particularly as to the conditions under which hay can be dried. Because one crop has been successfully dried no would-be experimenter should imagine that other crops can be successfully dried under the same or different conditions. Farmers would be well advised to wait for a short time until more precise information is available, and full and definite directions can be drawn up for their guidance.

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AGRICULTURAL DISCUSSION SOCIETIES.

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CO-OPERATION is often mentioned at the present time as a means by which the business of agriculture may be made more profitable, and there is no doubt that in theory the principle of co-operation is one of the most satisfactory remedies for many of the difficulties with which farmers are faced during the prevailing agricultural depression. Co-operation for the common good is the basis of civilisation, and its intelligent application to the agricultural industry in all its branches would, subject to the loyalty to each other of those engaged in the industry, go a long way towards its salvation.

Co-operation is generally understood to apply to the buying and selling of produce, but that is only a small part of its functions, there being many other directions in which the co-operation of agriculturists might benefit the industry. One field of co-operation which has been little explored is that of agricultural education.

Until recent years farmers have had considerable doubt as to the practical value of agricultural education and research. To-day conditions have largely altered. Research is constantly bringing to light new discoveries of very great practical importance to farmers. There is, however, still a gulf between the research worker and the farmer who should benefit from the research. The connecting link is generally the County Agricultural Organiser and his staff, but the Organiser works under many difficulties, and his time is largely taken up with administrative work and with endeavouring to break down the prejudice of farmers against agricultural education. If he succeeds in this a second difficulty awaits him, as the demand for agricultural education rapidly exceeds the supply and he finds himself unable to cope with it alone or with the limited staff generally available. It is possible to find a remedy for this state of affairs by the application of co-operation to agricultural education, by means of the formation of Agricultural Discussion Societies.

The members of such a society (farmers, landowners, farm workers and others) meet periodically to pool their experience and discuss methods by which their practical difficulties may be overcome. The objects may be briefly summarised as "the promotion of a healthy interest in all agricultural matters, both practical and scientific, by affording opportunities for the exchange of views on matters of importance, by means of lectures, discussions, demonstrations, visits to farms, and experiments, or by any other means which may be deemed advisable."

Unlike the usual system of education which aims at the teaching of young men who will be the farmers of the future, the Agricultural Discussion Society aims particularly at providing education for those actually engaged in farming. The lectures and discussions arranged deal, therefore, with the findings of research workers and the practical application of their results to the system of farming practised on the farms of the members themselves.

Formation of a Society.—In forming a society the method of procedure is to organise a lecture on some special subject to be given by an expert on that subject. This lecture should be of such a nature as to convince those present that there is something of practical value to be learnt from agricultural education and should make the audience ask for more. Provided the necessary enthusiasm is aroused, a President, Vice-Presidents, Secretary and Committee are appointed, and they in consultation with the Agricultural Organiser draw up the programme for the year. Lectures are arranged either weekly, fortnightly or monthly during the winter months, and are given by members of the County and Agricultural College staffs, experts from the Ministry of Agriculture, veterinary surgeons, practical farmers and others who are in any way connected with the industry.

Some idea of the scope of the work may be gained from the following example:—In Devon, which has now seven societies, lectures have been given by nine members of the county agricultural staff, five members of the staff of the Ministry of Agriculture, six members of the staff of the Seale-Hayne Agricultural College, thirteen local farmers and thirteen other lecturers. The 70 lectures dealt with such subjects as improvement of grass land, seeds mixtures, lime, poultry keeping, Devon cattle, farm accounts, veterinary first aid, the bacon industry, pig feeding, agricultural law, farm valuations and assessments, feeding of dairy cows, weeds and their destruction, farm implements and machinery, etc. In the summer lectures are not given, but trips are arranged to farms and experimental stations in the county and outside.

The first society was established by the writer at Brompton, near Northallerton, Yorks, 1921, and is still functioning successfully. Similar societies have recently been formed in other counties.

It is seldom desirable to form a society unless fifty members can be obtained, and these members should pay a subscription of from 1s. to 3s. to cover local expenses for hire of room, etc., and to ensure that only those who are interested shall obtain the privileges of membership.

Combined Meetings of Societies.—A further stage is the combination of societies in prescribed areas. If societies are formed at distances of 5 to 10 miles from a central society it becomes possible to hold occasional combined meetings, thus getting together audiences of several hundreds, with the result that special lecturers may be brought into the county. This also enables an exchange to be worked between neighbouring County Organisers, and as a consequence much good results to the work of the counties concerned.

A large number of experimental and demonstration plots are laid down on the farms of members of the societies, and it is possible to arrange periodical demonstrations on these plots for the benefit of the members. During 1923 a party of 120 farmers from four societies visited H.R.H. the Prince of Wales' farms in Cornwall, and a party of over 80 farmers visited experimental plots in East Devon on 8 farms, during an afternoon in August.

Proceedings at Meetings.—The lecturer at a Discussion Society meeting lectures on his special subject. The lecture may last an hour or an hour and a half, and should be followed by a discussion which may be of equal duration. In this discussion questions should be asked the lecturer, who should reply to them as soon as they are asked, and other members of the society may support or differ from his answers. The discussion should not be confined to the asking and answering of questions, but should rather be an effort on the part of members of the society to arrive at a solution of the problems under discussion. Where doubt exists on any point, arrangements may be made to carry out experimental work.

As a rule the best and most lively discussions occur after lectures by farmers, as there are invariably a great many things practised by a farmer of experience which do not possess any scientific foundation, and on which other farmers no less practical will hold entirely different views.

The value of these societies lies to a large extent in the part which the members take in their own education, and in the fact that the instruction given through the societies is carried on for a number of years, and is not, as in the case of a course of lectures, finished at the end of one season. The result of this is that the members of the societies are able to judge on their own farms of the success or otherwise of the instruction given and are also able to state their experiences of new methods at meetings of the societies held in after years. Members of societies not only attend with the object of learning but are also expected to assist in furthering the instruction provided, and the more they disagree with the lecturer the better the discussion and the greater the educational value. The mixing of old and young farmers, together with farm workers and land-owners, brings many different points of view to bear on problems under discussion. The young farmers speedily gain information from the older ones present, while the older ones realise that the young men do not intend to be satisfied that the practices of their fathers are correct without first testing the value of the new methods advocated.

As far as the County Organiser is concerned, he will find that the running of a society results in great economy in the work of his staff, and consequently a far greater amount of work can be accomplished with the staff available. The variety of subjects dealt with, and the variety of lecturers, are additional advantages, and help to maintain interest. The discussions at meetings of these societies form a very useful means of training young farmers in public speaking, an important matter in these days of active Farmers' Unions.

From a scientific point of view, the Agricultural Discussion Society forms an excellent link between the farmer and the scientist. Discussions on many occasions bring to light differences of opinion amongst practical farmers which call for further investigation by the scientist. Societies also provide a convenient medium for the distribution of pamphlets and other published information.

The writer looks forward to the time when every county will have its Discussion Societies, and when every important agricultural district in each county will have a society. Judging by the success of the societies already established, great progress in agricultural education will be made when this state of affairs is brought about. The Farmers' Unions, which have done such good work for the agricultural industry generally, cannot afford to miss this opportunity to increase their power for good by bringing their members into closer contact with each other.

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METHODS OF COVERING GRASS SEEDS.

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THE results of previous investigations on the depth of covering best suited to the seeds of various grasses and clovers, and as to the methods of covering most applicable to ordinary field conditions have been published in this *Journal.**

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* *Depth of Sowing Grass and Clover Seeds*, by R. D. Williams, April and May, 1922; *Methods of Covering Grass and Clover Seeds*, by R. D. Williams, March, 1923.

In order to throw more light on this important practical problem and to make the investigations more comprehensive, a further series of experiments was carried out in 1923 on the methods of covering the seeds of perennial rye grass, meadow foxtail, timothy and rough-stalked meadow grass.

It is often recommended that the large and small seeds constituting a mixture should be sown separately, and that the large seeds should be harrowed in before sowing the small seeds, which should be left on the surface or merely rolled in. On *a priori* grounds this view seems quite sound, since seeds of different grasses and clovers have different depth requirements.

In order to ascertain if this is the case in actual practice, representative grasses with large seeds (perennial rye grass and meadow foxtail) and others with small seeds (timothy and rough-stalked meadow grass) were selected for the experiments here dealt with. The trials were carried out on a fairly uniform medium loam which had carried an oat crop in 1922. The soil was in good condition and an excellent seed bed was obtained. The seeds were sown broadcast by hand on 16th June, without a nurse crop, on long narrow one-hundredth acre plots, 72.6 feet long by 6 feet wide.

The seeds were covered by farm implements commonly used for the purpose. The methods of covering adopted were:—

(1) Seeds uncovered; (2) Smooth roller; (3) Horse hay-rake, followed by smooth roller; (4) Chain-harrow, followed by smooth roller; and (5) Light peg-harrow, followed by smooth roller. Each species was sown on 20 plots, 4 plots being allocated to each method of covering, of which two were chain-harrowed and two rolled as the last operation before sowing.

The four species were sown at the uniform rate of four million viable seeds per acre, that is, at the rate of 91.8 viable seeds per square foot. The percentage (laboratory) germination of the seeds of each species was as follows: perennial rye grass 94, meadow foxtail 92, timothy 98 and rough-stalked meadow grass 73.

The seedlings were counted on 11th to 16th August by taking 40 readings per plot with 6 inch meshes. These results are summarised in Table 1 hereunder, which shows the average number of seedlings per square foot of perennial rye grass, meadow foxtail, timothy and rough-stalked meadow grass on plots covered by different methods.

TABLE I.

Last operation before Sowing.	Method of Covering.	Perennial Rye Grass.		Meadow Foxtail		Timothy.		Rough-stalked Meadow Grass.	
		Seedlings.	Probable Error.	Seedlings	Probable Error.	Seedlings.	Probable Error.	Seedlings.	Probable Error.
Chain-harrowed	1	12·0	± 0·43	3·1	± 0·29	12·0	± 1·72	14·0	± 0·55
	2	16·9	± 0·57	7·0	± 1·26	21·0	± 1·86	21·9	± 1·00
	3	27·5	± 0·72	9·4	± 0·38	25·6	± 0·26	20·6	± 2·19
	4	44·7	± 1·57	14·0	± 0·88	33·7	± 0·57	25·5	± 1·74
	5	42·2	± 2·41	15·5	± 2·27	23·6	± 0·17	20·7	± 0·14
Rolled	1	9·7	± 0·48	4·1	± 0·38	11·6	± 0·62	13·8	± 0·86
	2	15·4	± 0·86	5·2	± 1·03	20·3	± 1·57	20·9	± 0·21
	3	26·1	± 1·05	7·3	± 1·12	15·1	± 1·84	22·8	± 0·72
	4	41·6	± 1·62	9·6	± 0·74	21·2	± 0·93	23·7	± 0·88
	5	41·8	± 1·67	8·5	± 0·29	16·4	± 1·19	22·3	± 0·74

The average depth at which the majority of the seeds were covered by the different implements was as follows: roller ⅛ in., hay rake ¼ in., chain-harrow ½ in., peg-harrow ½ in.

Discussion of Results.—*Perennial Rye Grass.*—It will be seen from the figures in the Table that the plots covered by the chain and peg-harrows gave very similar results. These plots had far better stands than the plots covered by the other methods. The uncovered plots had only about 28 per cent., while those covered by the roller and horse-rake had only 38 per cent. and 62 per cent. respectively of the number of seedlings found on the chain-harrowed plots.

It will also be seen that the plots sown on a chain-harrowed surface gave in every case slightly better takes than the corresponding plots which had been rolled prior to sowing, but the differences are probably too small to be of practical significance.

Meadow Foxtail.—As in the case of perennial rye grass there was very little to choose between the peg and chain-harrows as implements for covering meadow foxtail. Both these methods resulted in better takes than any of the other methods of covering. On the plots chain-harrowed before sowing, the number of seedlings on the uncovered plots was only 21 per cent., on the rolled plots 50 per cent., and on the raked plots 61 per cent. of the number counted on the chain-harrowed plots.

The strikingly low figures obtained for this grass under all methods of covering are, no doubt, largely accounted for by the fact that the seeds were not properly covered by any of the methods, for even when covered by means of the peg- and chain-harrows a much larger proportion of meadow foxtail seeds was left exposed than was the case in any of the other seeds experimented with. In this connection it is interesting to note that the figures in the table show that rolling the plots before sowing did not give rise to as satisfactory takes as on the chain-harrowed surface. For instance, the plots rolled before sowing and then covered by the peg-harrow had only 56 per cent. of the number of seedlings counted on the corresponding plots which had been chain-harrowed before sowing. The greater resistance offered by the rolled surface to the large and very light meadow foxtail seed probably explains the inferiority of the plots so treated.

Timothy —The data obtained for timothy seem to suggest that the small plump seeds of this grass were covered too deeply by the peg-harrow. The best results were given by the chain-harrowed plots. The uncovered plots and the plots covered by roller only were again poor.

The raked, chain-harrowed and peg-harrowed plots which had been rolled before sowing had, for reasons which cannot be explained, much poorer stands than the corresponding plots which had been chain-harrowed before sowing.

Rough-stalked Meadow Grass.—The stands of rough-stalked meadow grass were not nearly so much influenced by the methods of covering as the other three grasses. Although the best results were obtained, as in the case of perennial rye grass, timothy and meadow foxtail, on plots covered by the chain-harrow, yet even the uncovered plots had 55 per cent., while the rolled plots had 86 per cent. of the number of seedlings on the chain-harrowed plots.

Despite the fact that all the rough-stalked meadow grass plots gave very poor results relative to the number of viable seeds sown, nevertheless the figures given in Table I are undoubtedly too high as they include a certain proportion of indigenous plants obtained from self-sown seeds. This is proved, for example, by the fact that the meadow foxtail plots had on the average as many as 7 seedlings per square foot of self-established rough-stalked meadow grass.

Conclusions.—The results of these experiments show quite definitely that chain- and peg-harrowings were by far the most effective methods for covering the large seeds of perennial rye grass and meadow foxtail. These results agree very closely with the results of previous investigations already referred to, in which it was shown that the best takes of Italian rye grass, cocksfoot and red and white clovers were obtained when the seeds were covered by these two implements.

Moreover, the results indicate, for the conditions under which the investigations were conducted, that even small seeds such as timothy and rough-stalked meadow grass have to be thoroughly covered in order to give the most satisfactory stands. Both timothy and rough-stalked meadow grass produced poorer takes when the seeds were left uncovered or merely rolled in than when they were chain-harrowed. The rapidity with which the delicate root-hairs of the exposed seedlings are dried up is, no doubt, mainly responsible for the comparative failures of the seeds not properly covered.

The most satisfactory takes of timothy and rough-stalked meadow grass were obtained by covering the seeds by means of the chain-harrow. The tendency of the peg-harrow was to cover these small seeds too deeply. The horse hay-rake, although it gave better results than the roller, was an inferior implement to the chain-harrow for covering both large and small seeds.

As will be seen from the figures given below, there was a wide discrepancy in the case of each species between the number of viable seeds sown and the number of established seedlings, even on the plots with the best takes:—

	Number of Seedlings per square foot on the best Plots.	*Ratio of Seedlings per square foot to viable Seeds sown.*
		Per cent.
Perennial Rye Grass... ..	44·7	48·7
Meadow Foxtail	15·5	16·9
Timothy	33·7	35·8
Rough-stalked Meadow Grass	23·7*	25·8*

The number of viable seeds sown in each case was 91·8 per square foot.

Thus within so short a period as two months from sowing the number of established seedlings of perennial rye grass was less than one-half, timothy about one-third, meadow foxtail less than one-fifth, and rough-stalked meadow grass about one-quarter of the number of viable seeds sown.

It is beyond the scope of this paper to inquire into the causes for the very heavy soil casualties which have been shown to occur. It would seem to be indicated, however, that although laboratory germination figures afford a valuable index as to the viability of seed, they do not necessarily afford much guidance as to the behaviour of the seed under field conditions of germination and establishment. Notes taken on the plots suggest, however, that slugs and other small soil fauna are undoubtedly responsible for a part at least of the casualties, and this is one aspect of the case demanding further inquiry.

Summary.—The evidence discussed here and in the papers previously published may be summarised briefly as follows.

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* These figures include a certain number of self-established seedlings and are therefore too high.

It should be emphasised, however, that these general conclusions apply only to the species and implements tested, and that they do not necessarily hold good for other grasses and clovers, and other methods of covering.

(1) It has been shown that good takes of the grasses and clovers tested depend very largely upon the thoroughness with which the seeds are covered. Even the small seeds of timothy and rough-stalked meadow grass have given far better takes when harrowed in than when left on the surface or when merely rolled in.

(2) Of the implements employed the best for covering the large seeds of Italian rye grass, perennial rye grass, cocksfoot, meadow foxtail and red and white clovers were the peg and chain-harrows. These two implements gave about equally good results.

(3) The chain-harrow proved a better implement for covering small seeds than the peg-harrow.

(4) The horse hay-rake and the Cambridge roller did not give as reliable results as the harrows.

(5) Apparently there is no advantage to be gained by sowing the large and small seeds of a mixture separately, provided the seeds are covered by the chain-harrow.

(6) Although the differences between the results of the two pre-sowing operations were in most cases small, yet the plots which were chain-harrowed as the last operation before sowing gave, on the whole, slightly better stands than the plots which had been rolled immediately before sowing.

(7) There was a very considerable but an unaccountable loss of viable seeds amounting to about four-fifths of the seeds sown in the case of meadow foxtail and rough-stalked meadow grass, even when the seeds were covered by the most effective implement, namely, the chain-harrow.

In conclusion the writer's grateful acknowledgments are due to Messrs. W. Davies, B.Sc., C. Jones, B.Sc., J. G. Davies, D. E. Milton and G. Evans, B.Sc., for valuable assistance in making the numerous readings.

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SWEDE AND TURNIP SEED GROWING IN KENT.

CHARLES CREERY.

AN account appeared in this *Journal* for July, 1923, p. 358, of turnip, swede and mangold seed growing in Lincolnshire. In the famous Romney Marsh district of Kent, where a large acreage, chiefly swedes, is grown, the methods of growing, harvesting and thrashing are so different, that it may be of interest to compare the two systems. Each is no doubt the most suitable to the respective district. Swede and turnip seed, grown in these Marshes, have a great reputation for their keeping qualities. Only a small acreage of turnip seed is now grown in Romney Marsh. Many farmers prefer it to swede, as it comes earlier, and is less liable to "canker" and to attacks of the "fly" or flea beetle, but the price to the grower is less than for swede seed.

The same methods of cultivation are adopted for both turnip and swede seed.

Seed and Sowing.—In Romney Marsh, the crops for seed purposes are seldom drilled to stand. The plants in almost every case are grown outside the Marsh area, usually on the higher ground to the north of the old Royal Military Canal, between Rye on the west and Hythe on the east. Some are grown at considerable distances from the seed district, and are brought by motor transport, which, though more expensive, is preferred by many.

The most suitable ground is either a fallow or after early potatoes. For swede seed the best land is that which has been broken up recently; heavy crops can be grown for many years with proper rotation.

The stock seed for the plants should be sown about the middle of August; unless the weather is very favourable, great risk is run if sown later than the third week in that month. If dry weather sets in, the plants may be some time coming, and until the third leaf is developed they are in danger from frost. Turnip seed may be sown rather later than swede.

To grow plants satisfactorily, the ground should be thoroughly cleaned, and a fine seed-bed prepared. As much care is necessary as with any other crop, but this is not always recognised.

The stock seed for the plants is sent by the seedsmen to the farmer, with whom they have contracted to grow the seed at a price per cwt.; and he forwards it to the man who is to grow the plants for him at so much per acre planted. One gallon of stock seed is sufficient in an average season for 5 to 7 acres of plants. The seed is sown either broadcast or by seed barrow, and covered in by harrows, sometimes followed by a light roller. Broadcasting seems still to be the most reliable method, as a more even plant is obtained, if done by experienced men.

Planting and Cultivation.—If the weather is suitable, and it has been possible to get the ground ready, the plants should be set out about the middle of November. Plants one inch in circumference are a fair size. Planting can go on continuously from November until the end of February, unless the ground is very wet or hard. It is not advisable to plant later than this. The distance between rows should be about 2 ft., and the plants dibbled in from 12 to 15 inches apart.

Cross harrowing and rolling often help the plants before they reach any size if attacked by slugs or wireworms. As soon as weeds appear the ground requires shimming and hoeing. The shim cannot be used too often, until the plants are ready to earth up about the latter part of April. After this is done they can be left to take care of themselves.

The majority of growers in this district favour topping, or cutting back about 6 inches, before the plants commence to bloom. If they are inclined to run up this checks them and helps them to branch out. The need for this does not always arise, but in most cases it is the practice.

Rogueing, *i.e.*, taking out the false plants, requires special attention, in order to keep the stock true. Amongst swedes, a turnip, or some bastard swede, will be distinguished by its bright yellow flower. In many cases the farmer will take these out as he comes across them. It is, however, usual for the seed merchants to send their own experienced men to do this work, as often it is only by a slight difference in the colour of the bloom and the lower part of the stem that rogues can be detected.

Cutting and Thrashing.—Cutting takes place towards the latter part of July for swedes. Turnips may be three weeks earlier. The pods should have a good purple brown colour when ready. Some farmers are inclined to cut rather too soon, but in certain seasons it is very difficult to judge exactly the right moment. The tops are cut off about eighteen inches from the ground and laid carefully in rows.

Thrashing will commence in from ten days to a fortnight afterwards, according to the weather, but the seed must be quite ripe or it will not keep well and its value is reduced.

A large sailcloth is laid out in the field, and pegged down, with the sides slightly raised. Sledges on runners or small wheels are then drawn between the rows, and the straw picked up very carefully and placed in the sledge with tops inwards to avoid seed scattering. They are then turned over on to the cloth, and the straw arranged in a circle. A light horse roll is taken round over it, and the straw shaken out by men with forks as the roll passes. This appears a rather primitive way of thrashing, but it is quite effective. It has one great advantage over a machine—there is no fear of seed getting mixed. With a machine, unless the greatest care is taken in cleaning, much trouble may arise after each different sort is thrashed.

When thrashed, the seed is put through a blower on the ground and then taken to the granary where it is cleaned.

Diseases and Pests.—"Canker" is the name locally in use for a disease which possibly starts in the plant bed. It is not as a rule noticed until the plants are fit to hoe, about the second week in March. The first sign is a slight bluish tinge in the leaf; and if the hoe touches it, the plant will probably break off. If a plant is pulled up with care there may be nothing to indicate disease, but on cutting through from the crown downwards the rot is exposed. Plants affected in this manner have been known to hold out until cut, if well earthed up, but in high winds they usually fall.

Snails and wireworms frequently eat into the smaller plants, just below the surface of the ground. This in time causes rot, and is often mistaken for canker.

Maggot or "bladder" is in evidence every year in the pods, often causing a loss of 20 per cent. in the yield of seed. Last year, although every other pest was abundant, the pods affected by maggot were negligible: they had not been so free for many years.

Rooks may do considerable damage to young plants, pulling out whole rows in search of wireworms. Linnets and doves take a heavy toll just before the seed is ready to cut.

Flower beetles are without doubt, the greatest enemy to the swede flower, and the most difficult to attack with any success. It is always present to some extent when plants are in bloom. For several years it has done serious injury, and in 1922 it destroyed almost the entire crop. Nothing has yet been found that is of real practical use against it.

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ORGANISED DAY COURSES IN AGRICULTURE.

THERE are throughout the country a large number of young farmers, farmers' sons, and other persons interested in agriculture for whom, owing to considerations of time and money, a course at an agricultural college or farm institute is impossible. Such persons are a distinct class demanding special consideration on the part of those responsible for providing educational facilities, since such time as they can devote to instruction is, by reason of their environment and occupation, both limited and seasonal. It is for such students, of ages mainly from 16 to 35, that Organised Day Courses are primarily designed, and such courses are being successfully conducted at various centres. The object of this article is to outline a course adapted to meet the average demand. Suitable modifications will suggest themselves in connection with, for example, the type or sex of student attending such classes.

The question arises as to how far the substance of the courses of one to three years at an agricultural college can be modified to meet the needs of organised classes such as are here contemplated. Such teaching usually progresses from the fundamental pure sciences through their applied aspects to the unifying subject of agriculture which interweaves these different scientific threads with farm management and business methods.

In addition to the imparting of facts it is the object of the teacher to develop powers of observation and the faculty of thinking clearly, and, if this educational return is to be obtained in a course that has to deal largely with matters of immediate practical application, the isolation of facts and even sectional treatment of the subject must as far possible be avoided.

Though the standpoint of the teacher in an Organised Day Course must differ from that of one engaged at a college or institute, and though considerations of time will limit his selection of material, yet the fundamental truths he must seek to inculcate are the same as in a course of greater pretensions. They are, shorn of all elaboration, the story, simply told, of how a plant grows and how an animal lives. The teacher should remember, too, that he is not only instructing young farmers in the reasons for their practice, but is also explaining farming as a business and pointing the way to improvement. By the selection of matter that is of immediate local interest, not only is the necessary confidence established between teacher and pupil, but attention is directed to all aspects of the system of farming common to the district.

The basis of teaching should be the system of farming practised in the given locality, and, following on the simple discussion of the elementary scientific and economic principles underlying farm practice, the development of a broad co-ordinated view of the business of farming as a whole should be attempted. The business side of the industry should always be kept to the forefront, the influence of fundamental financial considerations on the practice and conduct of the farm should be demonstrated, and such alternatives should be suggested as can be justified on economic and scientific grounds.

In the following pages an attempt is made to apply the general principles stated above to the framing of a syllabus for a suitable course in agriculture. Allied subjects such as horticulture, dairying and poultry-keeping, except in so far as they come within the range of mixed farming, are not included. The treatment of these subjects in detail would not be generally advisable or possible in these classes, and must necessarily be reserved for special courses as occasion demands. Nevertheless, in the course of general lectures, indications would be given of lines likely to be profitable locally, and therefore deserving of supplementary courses. Comprehensive syllabuses of certain specialised branches of farming are included in the addenda as suggestions for adoption where a demand for instruction in these may exist or arise.

While there is no desire to interfere with the discretion of the teacher, or with local requirements, it may be stated that a convenient arrangement has been found to be one day of four to five hours a week at each centre for a period of twelve to thirteen weeks, and the number of students should not exceed twenty.

The course may be classified under the three heads, A. Crop Husbandry; B. Animal Husbandry; and C. Farm Management. These are dealt with below.

A. Crop Husbandry.

(*a*) *The Soil.*—Origin and properties of soils; examination of the different soils and subsoils with special reference to local types (arable and pasture); sandy, clayey, peaty, and chalky soils; temperature and aeration of soils; soil moisture; soil bacteria.

(*b*) *Principles of Cultivation.*—Effects of ploughing, harrowing, rolling, etc., preparation of seed bed; modifications of the soil; draining, sub-soiling, bare fallowing, cultivating; liming; manures, natural and artificial.

(*c*) *The Plant.*—The structure of the plant; essentials of plant growth—air, water, food, heat (leading up to a general consideration of farm crops from an elementary botanical standpoint); cereals, pulses, roots, grasses and clovers.

(*d*) *Principles of Rotations.*—Inter-relationship of cropping and stocking with spcial reference to the system prevailing locally; crops of the rotation dealt with individually—their cultivation, manuring, harvesting and disposal.

Weeds, and their eradication.

Grassland—valuable, useless, and harmful plants in meadows and pastures; management.

B. Animal Husbandry.

(*a*) Elementary physiology and anatomy of different classes of stock; principles of breeding, rearing, and feeding, management in health and disease.

(*b*) Types of animals.—(1) The horse—faults in leg and feet. Shoeing; (2) Cattle—dairy stock and beef cattle; (3) Sheep; (4) Pigs.

(*c*) Feeding and management of live stock, compilation of rations, and economic use of purchased and home-grown foods; milk recording; improved methods of meat and milk production.

C. Farm Management.

(*a*) Business principles; use of farm diary and records; bookkeeping, simple accounts, cash analysis system, preparation of Profit and Loss Account, the Balance Sheet; income tax assessment, basis of rating and taxation; method of determination of costs of production; valuation of manures, feeding stuffs and unexhausted residues; farm arithmetic and elementary surveying.

(*b*) Law of Landlord and Tenant; Farm Capital; Tenant Right Valuation—basis and method, and custom of the county.

(*c*) Co-operation, distribution and supply.

(*d*) Machinery and care of implements.

(*e*) Organisation of labour.

(*f*) Production costs.

It is not suggested that all instruction should be given in the form of lectures. Excursions to neighbouring farms should be made, thus giving the teacher the opportunity of illustrating his teaching and encouraging discussion and inquiry amongst the students.

It is neither possible nor desirable to teach manual processes otherwise than by demonstration of methods and recognition of good and efficient workmanship. The training of a skilled worker is as much a question of time and practice as of instruction.

HORTICULTURAL SYLLABUS.

Study of the Plant.—General structure; functions of leaves, roots, stems and flowers; nutrition, assimilation, respiration, transpiration, growth; essential conditions for growth; seeds and their germination.

The Soil.—Its composition, properties, kinds; water supply; plant food; the principles of manuring, farmyard manure, artificial manures; cultivation.

Pests.—An introduction to the study of fungi and insects; life history of a few common pests.

Vegetables.—Kinds, main points in cultivation; rotation; manuring; production of early and late crops.

Fruit.—Kinds; recognised market varieties; general cultivation and treatment; stocks; propagation; grading; packing and marketing.

Crops under glass.—Crops suitable for cold frame, houses, etc.; main points in the cultivation of tomatoes, cucumbers, etc.

Flowers.—The best market kinds—daffodils, sweet peas, wallflowers, chrysanthemums and carnations.

DAIRYING SYLLABUS.

1. *Importance of Cleanliness in Dairying.*—Contamination—(*a*) Visible, (*b*) Bacterial; preventive methods.

   Bacteria, ferments and enzymes in milk; harmful and beneficial kinds; how they help or defeat the cheesemaker; rate of increase (1 into 2 in 20 minutes—calculate number in 24 hours).

   Means of checking action—(*a*) Pasteurisation, sterilization and refrigeration.

   Material required.—Diagrams of different forms of bacteria; explain minuteness, will pass through strainer; explain action in producing starter and gassy curd.

2. *Methods of Handling Milk.*—(*a*) Cowshed, clean, light, and well ventilated; (*b*) cows' hindquarters clipped, groomed and washed; (*c*) milkers' hands and clothes clean; (*d*) utensils clean and sterile; (*e*) cooling; (*f*) strainers, cotton pads.

   Material required. — Pamphlet showing simple steam sterilizer; glass flask and Bunsen burner or other heating arrangement; photographs illustrating the methods adopted when clean milk production is practised.

   By means of a special thermometer show difference in temperature between hot, scalding and boiling water.

3. *Dairy Appliances.*—Milking; buttermaking; separator; cheesemaking; testing; chemicals and glassware; defects in utensils and effect on milk; care of utensils; thermometers.

   Material required.—Dairy catalogues in which to point out the various utensils and discuss the material of which they are made, and their advantages or disadvantages for the purpose for which they are designed.

4. *Milk.*—Properties and composition of whole milk, separated milk and cream; effect of heat and rennet on milk; law regarding milk; grading.

   Material required.—2 glass jars; some rennet and Bunsen flame or other means of heating. Experiment—Almost fill jars with milk and to one of them add rennet and show separation into curds and whey; apply heat to the other jar and observe results. Explain pasteurisation and sterilization.

5. *Milk Products.*—Cream, butter, cheese, their composition, manufacture and marketing; marketing of milk.

   Material required.—Small portion of starter, discuss its use in cheese and butter-making; cream containers, butter paper and cartons, cheese calico. If facilities available take a fat test of milk and cream.

6. *Food Values of Milk and Milk Products.*—Comparison with beef, potatoes, fruit; value of milk for children and invalids; necessity for care in handling; wastage due to improper handling; various dishes which can be prepared from milk and milk products.

   Material required.—Chart showing comparative food values of various substances; add rennet to milk to make junket, give recipes for various dishes.

7. *Milk Testing.*—Analysis; acidity; visible dirt content; bacterial content.

   Material required.—Gerber tester and chemicals; acidimeter and chemicals; Gerber dirt tester; petrie dish; lactometer and thermometer; slide rule.

Take test for fat content and calculate total solids by means of lactometer, reading by means of slide rule; take tests for acidity and explain function of neutralizer and indicator; take test for visible dirt; show prepared petrie dish and discuss method of preparation.

8. *Breeds of Dairy Cows.*—Points of dairy cow; udder and milk vein; diseases of udder and how they affect the milk supply; washing hands after milking each cow as a means of preventing transmission of diseases.

Material required.—Charts of 3 or 4 breeds of dairy cows; chart showing points of typical dairy cow; anatomical chart of udder.

SMALL LIVE STOCK SYLLABUS.

Poultry on the Farm.—System of management; destruction of insect pests; improvement of grassland; value of manure.

Breeding of Fowls.—Suitable varieties; breeding; selection; management.

Feeding.— Utilisation of farm products; feeding for egg production; fattening.

Incubation.—Natural methods; use and management of an incubator.

Rearing of Poultry.—Artificial brooding; feeding chickens; treatment of young stock; ducklings.

Housing of Poultry.—General principles; suitable types; materials and construction; temporary shelters; general equipment.

Duck Keeping and the Breeding of Geese.—Egg production; table ducks; rearing of goslings.

Turkey Breeding.

Common Disease of Poultry.—Prevention and treatment; roup; disease of the liver; gapes; intestinal diseases in chickens.

Goat and Rabbit Keeping.—Value to the farm labourer; breeding and management of goats; fur production from rabbits; management.

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WATERCRESS AND ITS CULTIVATION.

A. H. HOARE,

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THE value of watercress in the national dietary was emphasised at the last meeting of the British Medical Association. In addition to the already established medicinal properties derived from its oily and mineral contents, it possesses, in common with other green salad plants and with fresh fruit, an important value from the point of view of general nutrition, since it is a source of those active chemical bodies known as vitamines which appear to play a vital part in healthy nutrition.

Apart from the fact that watercress should be readily obtainable all the year round, it has the further advantage over other salad crops that it is cheap enough to be within the reach of everyone. Such a source of healthy green food should not, therefore, be neglected, and the following notes upon the plant and its cultivation may be of some assistance in stimulating its production in this country.

Watercress (*Nasturtium officinale*) is a cruciferous aquatic plant, and is indigenous to Great Britain as well as the rest of Europe and Asiatic Russia. It has also spread to Northern America and has established itself in many of the British Colonies.

As an edible plant it has been recognised almost as far back as history records, and is frequently referred to by writers of the Greek Classical Age under the name "*Kardamon*," and was regarded as a remedy for brain disorders, as the name, meaning "head subduer," implies.

The plant appears to have come under cultivation in this country about the year 1800, and to-day practically all the watercress placed on the market has been cultivated in specially constructed watercress beds.

The Plant: Description of Types.—Although all are derived from the natural species, there are three distinct varieties of watercress in cultivation. All three are a great improvement upon the wild plant, both as regards form and flavour. They are known to growers as dark green summer cress, light green summer cress and brown winter cress.

The two summer cresses are the varieties grown during the warmer months. They are both less hardy than the brown cress. The *Dark green summer cress* possesses leaves which are larger and bolder, with darker colour and fuller flavour and being less astringent than the light green variety. It also sells better and is the stronger growing type. The *Light green summer cress* more closely approaches the wild species in general aspect, but its flavour is considerably superior. It finds a ready sale on some markets.

The *Brown winter cress* is readily distinguishable, the green of the leaves being tinged with brown, particularly towards the edges. This browning becomes more marked in colder weather. This cress is mostly grown during the winter months, partly because it is hardier and partly because the market appears to demand a brown cress at this season of the year.

In commencing to cultivate watercress it is important to bear in mind these points as regards the varieties, and to make certain when purchasing stock that it is true to type. It is always best to go to a reliable grower for new stock, and to be certain beforehand which variety it is proposed to grow.

Cultivation: Water Supply.—The most important factor in successful watercress cultivation is the water supply. In the first place, whatever its source, the water must be absolutely

FIG. 1.—Modern Watercress Bed adjoining the River Wandle, near Wallington, Surrey, showing the Water Reservoir and light railway for transport of cress.

FIG. 2.—Showing the general lay out of a Watercress Bed, with packing shed in the centre.

free from contamination of any kind, and scrupulous care must be taken by the grower to guard against this occurring as long as the crop is under cultivation. For this reason streams of clear running water are usually employed, and as near as possible to their sources. An instance of this is the river Wandle in Surrey, which in its upper reaches is the source of water supply to several hundred acres of watercress beds.

Secondly, as it is impossible to grow watercress in the winter months with stream water, it will be necessary, if regular winter production is aimed at, to have access to a supply of spring water either on the spot or in close proximity to the beds. These points are not generally realized, but are important. The growth of watercress is mainly influenced by the temperature of the water. Stream water falls in temperature with the air, and at average winter temperature is useless for productive cultivation. On the other hand, spring water comes from the ground at an average temperature of about 48 deg. F. throughout the year and, providing it is kept under cover between its source and the beds, renders winter production a commercial proposition.

For the above reasons, therefore, watercress growers usually locate their beds by the side of shallow, quick-running streams near their sources and, if regular production throughout the year is desired, in localities possessing the principal water-bearing formations, such as the Chalk, the Greensands and New Red Sandstone.

If there are no available natural springs which may be utilised, deep bore holes are made into the water-bearing formation, and the " artesian wells " which are the result of these operations provide a constant and regular flow of water at a suitable temperature. Operations of this nature may be seen at Gomshall, in Surrey, where some of the largest areas of watercress beds in the south of England are located.

It is, of course, impracticable to make borings for water remote from watercourses, as the ultimate disposal of the water must be provided for whatever its source.

Before leaving the subject of water supply, references should be made to the fact that success or failure in watercress growing is often influenced considerably by the chemical nature of the water itself. Not all waters prove to be suitable, and in some the crop may refuse to grow altogether. This is due to the amount and assortment of minerals dissolved in the water, and spring water is particularly liable to variation in this respect. There are no definite data available upon this point, and beyond stating that a prospective grower should experiment on a small scale at the commencement, if there be any doubt, little can be said. A survey of some of the most successful watercress beds in the Home Counties points to the fact that water from the Chalk and Greensand formations is usually dependable.

Construction of Beds.—The construction of modern watercress beds is a big undertaking involving the outlay of a considerable amount of capital. While it is quite possible to construct beds on cheaper lines by employing rough and ready methods, experience has shown that this practice is more expensive in the long run. The cheaply constructed beds will probably require continuous patching to maintain them in an efficient condition, while, on the other hand, the well-constructed beds last in good condition for a long period. Apart from these considerations the cheaper beds, constructed as they usually are from rough timber and turf, afford greater facilities for the attacks of watercress pests.

It will save time and expense, therefore, if walls and footways are constructed of strong concrete on good foundations and the surfaces should be rendered smooth in finishing. A watercress bed should be about 25 ft. or 30 ft. in width and of convenient length to suit the site. The length should not, however, be more than about ten times the width.

The walls on either side, which will also provide footways, should be about 2 ft. in height and 18 in. width. At the head of the bed a strong reservoir is constructed and separated from it by a wall from 2 ft. to 3 ft. wide. This reservoir should be about 4 ft. or 5 ft. in width and 2 ft. in depth, and serves to maintain a sufficient head of water to keep the adjacent bed supplied. One feed pipe is provided and so arranged as to bring the water flow to the bed under absolute control. The water is fed into the reservoir direct from the supply and there must be provision for control and overflow. The surface of the bed should be about 1 ft. below the top of the wall and so made as to provide a gradual fall throughout its whole length in the direction of the flow. The wall at the end of the bed should be suitably provided with an outlet pipe.

Winter beds should, if possible, be narrower and shorter than summer beds, bearing in mind that the cooling down of the water will affect the growth of the crop. The water supply must also be kept under cover except when actually in the bed, and this applies to the reservoir also. The maxim for winter watercress growing must be "maintain the water temperature."

The foregoing notes outline briefly the principle upon which modern beds are constructed. As a rule, they are laid out in a series, the whole forming a large block of beds, but any arrangement of this kind is governed by the area and configuration of the site available. If the area of beds is extensive it will be found convenient to have a central position set aside for a packing house, and at intervals between the beds sets of narrow gauge rails with flat trucks to provide rapid and labour-saving transport of the cress to the packing house.

The accompanying photographs (Figs. 1 and 2) show a good example of the construction of modern watercress beds, with a central packing shed served by light railways.

Planting and General Management.—In order to maintain a regular supply for market the cultivation of watercress calls for constant and careful attention. The beds must be planted and managed judicially to attain this end and, furthermore, the grower must maintain a supply of stock for planting up freshly prepared beds. If winter cress is grown, it will be necessary to plant up stock beds at the conclusion of the season to provide stock for planting up the following season's beds. Similarly in the case of the summer cresses, although, as a general rule, the beds are freshly planted up in the autumn to become established by the following spring.

Roughly speaking, a crop of watercress takes about four months to arrive at the marketing stage from the time of planting. Once the bed has become established and the first cut taken, it will re-grow fairly rapidly and may be cut over at frequent intervals according to the season and weather. It is not advisable, however, to leave the cress in possession of the bed too long and the latter should be cleansed, dressed and replanted at least once a year.

Beds are prepared for planting by being first thoroughly cleansed of all roots and stems of the previous crop. The beds are then "dressed" by admitting water freely, the surface of the beds being moved about thoroughly with wooden rakes so that the water can dislodge and carry away all traces of the old crop, foul mud, weeds, etc. The beds are then levelled down and firmed with the backs of the rakes. The water is reduced so that the surface is only just covered, and, when settled down, they are again ready for planting.

Planting is done by scattering a thin layer of the top growth of fully grown cress taken from the stock beds. This is done by hand, and care must be exercised to ensure an even covering of the bed's surface. The tops used for planting should be from 12 in. to 18 in. long. In a few days these plants will make roots from every joint, and as the cress becomes established more and more water is admitted to the bed.

Great care must be taken in regulating the water supply to a newly-planted bed, or there is danger of "swimming" off the plants before they become firmly rooted.

The planting of brown winter cress usually takes place during August and September, and should be completed by Michaelmas at the latest. The planting of summer cress usually takes place in late autumn—in which case it will stand throughout the winter—or in the spring, as soon as stock becomes available. It is emphasised that the regular production of this crop demands careful thought and judgment.

Marketing the Crop.—The cutting of watercress is performed with a large sharp knife, the operator holding the cress in one hand and severing the stems with the other. The cress is usually despatched to market in wicker baskets known as flats, each holding about 70 lb. Except in the case of special trade, the cress is not bunched by the grower, but is packed into the baskets loose, care being taken, however, to keep the heads level and compact, with the stalks packed outwards.

As the crop is of a perishable nature and must be marketed in as fresh a condition as possible, cutting and despatch must take place upon the same day to ensure that the cress will be on the market not later than the following morning. If the markets are at considerable distances from the grower's district, it is often necessary to commence cutting very early in the day. Growers in the south of England commence as early as 4 or 5 a.m. to catch the following morning's markets in Manchester, Glasgow and other northern towns:

Pests.—Watercress under cultivation is often attacked in summer by the mustard beetle (*Phaedon cochleariæ*), which devours the leaves voraciously, and the damage inflicted is sometimes severe. These small beetles are of a bright blue colour and are capable of multiplying rapidly. The small yellow eggs are deposited on the under side of the leaves, and the larvæ which hatch from them likewise feed actively on the stems and leaves of the cress.

This pest passes the winter in the adult stage among rough grass and rubbish, and for this reason watercress beds constructed with turf and wood for the sides are more liable to attacks than well constructed concrete beds.

Constant watch must be maintained for this destructive pest, and if it appears it should be dealt with immediately. Limited areas of attack may be handled by clearing out and destroying the attacked cress, but in the case of extensive attacks, the better method of control is by flooding the entire bed with water for a few hours, this having the effect of sweeping away the eggs, larvæ and adults.

In districts subject to the depredations of this pest all water-courses and the sides of the beds, if no concrete work is employed, should be maintained in a clean condition. in order to reduce the chances of the beetle finding comfortable winter quarters.

A fuller description of this pest is given in the Ministry's Leaflet No. 263.

Growing watercress is also liable to damage through the depredations of the fresh water shrimp (*Grammarus pulex*), which abounds in the rivers and streams of this country. The amount of damage done depends upon the number of this small Crustacean present, and if the beds are properly cleansed and dressed at regular intervals it should never be very great. It has been found that the application of a little lime tends to keep down this pest.

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FIG CULTIVATION.

THE Fig (*Ficus carica*) is a native of the south of Europe, northern Africa and western Asia. It has been in cultivation since the earliest ages, and there are many records of the estimation in which the fruit was held, especially by the Greeks. The ease with which it can be propagated from cuttings, its resistance to heat and drought, its early bearing and its value as human food had in the early ages much to do with its wide dissemination.

Botanically the genus *Ficus* belongs to the order *Moraceæ*, the characteristic of which is that the flowers are borne in a pear-shaped inflorescence. Thus in the fig. the so-called fruit is really a cavernous fruit-stalk with an opening at the top; in this hollow receptacle are borne numerous minute flowers, almost filling the cavity. The latter mature into small fruits or "seeds." These flowers are of two kinds. male and female; they are very simple in structure, the male flower being composed of several stamens on a long stalk, while the female is a one-celled ovary containing a single ovule.

In one form of *F. carica* the inflorescences contain female flowers; this type is known as *Ficus*. The other type containing male flowers only is known as *Caprificus*. The latter do not produce seed, but are utilised by a small species of wasp as a receptacle in which to lay eggs, the larvæ from which take the place of the seed. Pollen is carried by the wasp from the male flowers to the female inflorescences, and fertilisation takes place. In southern Italy and other parts of Europe where the fig has been extensively grown for ages, the majority of the trees planted are *Ficus*-individuals; amongst these are grown a few of the *Caprificus* variety, by which pollination is effected by means of the wasps. It is wrong to suppose, however, that this process which is known as "caprification" is essential to the maturing of the fruit; quantities of figs come from districts where no system of caprification is employed, and it is now generally agreed that with the exception of the Smyrna or Turkish fig, in which caprification is necessary, all the common cultivated figs produce well-matured juicy fruit without any external pollination whatever.

Fig cultivation in this country is carried on largely under glass, but in the south of England, particularly in the Worthing district, the trees of bush form are often grown in the open air. The young growths are liable, however, to be killed by severe frosts, though they not infrequently spring again from the roots. Considerably more damage is done by a canker of the wood, to which outdoor figs are particularly susceptible, and which is gradually causing a reduction of the acreage of this crop.

Cultivation for Commercial Purposes.—(*a*) *Under Glass.*—Under glass figs are occasionally grown as bush trees, but the usual method is to train the trees in the form of a fan, allowing the branches to extend as far as possible. Figs will succeed in any glasshouse where there is room for expansion, but a span-roofed house is, perhaps, the best shape.

Propagation of the trees is usually made from cuttings taken from one-year-old wood and rooted in pots. For two years the young plants are kept in a sunny position, and are then ready for planting in the permanent bed in the house. These beds are prepared by removing the two spits at the top and placing in rubble to facilitate drainage, and to prevent the roots running down into the subsoil. The top soil is then replaced and the trees planted out at distances of 12 ft. apart. The trees are pruned to form a narrow fan, and the shoots trained over wires fixed at about 2 ft. below the glass roof. If bush trees are desired the pruning and training is altered to form the right type of bush.

In the rich soils of Worthing practically no manure is given (except as a mulch to conserve the moisture), but the ground is generally limed at intervals of two or three years. Much water is needed, but it must be regulated with knowledge; the roots should not be allowed to become dry during winter, but the main waterings should be made during the growing periods. The supplies must be regulated with especial care during the ripening period, or the fruit is liable to crack.

As much light as possible is essential, and, if the foliage becomes overcrowded, a certain amount of summer pruning may be done. It is better, when adopting the "fan" method, to grow the trees in a house with glass sides, or with only a very low brick wall. A glaring light is detrimental and the houses should be shaded.

Figs will stand a considerable amount of heat, and may easily be forced; if this is done, as is generally the case at Worthing, three crops can be obtained every year. The house is started about the beginning of December and kept at a temperature of about 80 deg. F. The first crop is produced on the shoots of the past year's growth; and its success depends on the condition of this growth. It should not be soft, green or immature, but should be well hardened. If conditions are favourable, picking may commence at the end of March, and these first figs fetch the best prices in the market. The second crop is produced on the current year's growth, ripens in May and June, and produces the largest quantity of fruit, though the quality is less satisfactory. The third crop (which is sometimes removed to husband the strength of the tree) ripens in July, and usually produces abundant small fruits which fetch very little in the market.

(*b*) *In the Open.*—Figs are grown in the open at Worthing as bushes, planted from 15 to 18 ft. apart in ground which has previously been deeply cultivated and limed. The ground is kept well cultivated and free from weeds, but not liberally supplied with chemicals, for too rich a soil is not recommended. In some plantations no manure is applied; in others growers apply horse manure every year, especially when much dead wood has had to be cut out, and new growth is required. Little pruning is attempted, but dead wood and superfluous branches are removed.

The trees give two crops of figs a year, but as a rule only the first crop is taken. This crop is produced on wood of the preceding year's growth on short-jointed, well-ripened shoots.

The fruit sets in the spring and ripens in August or September. The second crop sets about August; the fruits grow to a small size, but seldom ripen.

Varieties.—The varieties of figs are exceedingly numerous in the countries where they are extensively cultivated; but many of them have not been tried in this country, and, as far as commercial fig-growing is concerned, the chief variety grown is "Brown Turkey," with "White Marseilles" as an occasional alternative.

Brown Turkey (Brown Naples, etc.).—The fruit is large, short and pear-shaped, with a grooved surface; in colour it is brown with sometimes a faint purplish tinge on the sunny side; the flesh is tinged with red at the centre and is rich and sugary. The fruit ripens early; the tree is an abundant bearer and one of the hardiest; and, while it forces well, it is also probably the best for outdoor cultivation.

White Marseilles (White Standard, etc.).—Fruit is large, roundish, and slightly ribbed; pale green in colour, becoming yellowish-white when mature; the flesh is succulent, sweet and rich. The tree ripens well against a wall and forces well.

Picking and Marketing.—The fruits are picked when nearly ripe and packed in trays holding one dozen fruits or in boxes holding four dozen. Extra special fruits are sent to market in shallow wicker "handles" containing four, laid on pink tissue paper on a bedding of wood wool. The first arrivals realise fairly high prices, but this falls as the season advances, and the final consignments realise but a small figure.

* * * * *

MARCH ON THE FARM.

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Agricultural Organiser for Derbyshire.

Weather Notes.—Normally March is one of the drier months of the year and is popularly regarded as windy: certainly east winds in this month have a very chilling effect. The mean temperature of the air, normally 41° to 42° F. in the Midlands, is about 2° above that of February but 4½° below that of April. The soil is ordinarily warm enough in March for the fairly quick germination of cereal grains; but seeds of certain troublesome weeds, such as charlock, usually do not begin to grow until warmer conditions return, about the middle of April.

The past winter has afforded a noteworthy illustration of the effect of temperature on germination of seed-corn. Winter oats and wheat drilled at the beginning of November lay dormant in the soil through ten or twelve weeks of abnormally cold weather, until about the first week in February, when, as a result of eleven dry and comparatively warm days, the plant suddenly appeared above ground. One correspondent, who at the end of December despaired of a field of wheat drilled on 31st October, reported on 5th February that it had come up exceptionally well. Even heavy land that was almost sodden in the middle of January came into sowing condition during the eleven fine days ending on 5th February, and opportunists were able to disc-drill one or two fields.

Grass Land.—Since the introduction of artificial manures, the effects of which on clean-bottomed grass land are usually very pronounced, little attention has been given to the possibilities of stimulation by tillage operations. Grass land ordinarily receives little cultural treatment beyond chain harrowing at this time of the year and, in the case of meadows, rolling and stone picking a little later in the season. In some districts pastures are not even chain harrowed.

There is diversity of opinion among farmers as to whether rolling increases the yield of grass. Rolling is usually desirable to level the surface for mowing; and on light land, or where the surface has been lifted by frost, consolidation appears to have good effects. On close-textured soils, however, rolling is of doubtful service. If heavy grass land is rolled when dry, the implement may make no visible impression; while if the soil is wet at the time of the operation, growth is checked by the deficient aeration which results, and the surface may even set hard. Rolling should be avoided where the sward shows signs of insufficient aeration—*e.g.*, the absence of worm castings, the presence of moss, and an inclination to become matted; the latter may, however, on light soils be due mainly to lack of lime.

Chain harrowing to spread manurial residues and worm castings may be performed equally well with either the plain link or the spiked implement. The effect is most beneficial when the soil is fairly dry on the surface: in the case of heavy land, injury may be done by smearing if the soil is wet at the time. On grass with an inclination to become matted in the bottom with dead fibrous matter, the spiked implement can render excellent service. A severe combing admits air, warmth, light and moisture, and accelerates the processes of decay and weathering in the soil.

There are many old meadow fields on strong land with short, close herbage which yield only light crops and are very unresponsive to manurial treatment. The fact that turf slitting awakened such land was known in this country a century ago, and at various times the favourable results of scarifying operations have been reported. More recently attention has been paid to this subject on the Continent, where several firms make implements designed to cut through the turf and open the underlying soil without tearing up much of the sward. Some of these implements are harrows with blade-like teeth; others are grubbers with knife coulters in the place of tines; and one of the latter has special shares which cut narrow grooves 1¼ in. wide by 2½ in. deep, at intervals of about 12 in. The soil and turf thrown out are afterwards spread by harrowing. The work of this implement is commended by Professor Strecker, of the Leipzig Machinery Testing Station, who has made numerous experiments in the tillage of grass land. The operation is effected in autumn or early spring.

Spring Corn.—Barley commonly follows turnips folded-on, and it is a rule of good husbandry to plough close behind the sheep; further, it is generally agreed that shallow ploughing is preferable to deep work in this operation. Grassy leas, especially two-year layers, are usually sown with oats, and this land is generally ready for drilling a little before that which grew root crops in the previous season. The rate of seeding varies from 4 bushels per acre on good land in early districts to 7 or 8 on poorer soils in high-lying or late country. Heavy seeding is a mistake on dry land.

The proper rate of sowing is about 2½ million good seeds per acre. The weight of seed required to give this quantity varies according to the sample. Small-grained oats (such as Potato oat) weighing 1 ounce per 1,000 seeds, require 156 lb. (3⅞ bushels) per acre: while large-grained sorts (such as Record, Crown and Victory) weighing 1½ oz. per 1,000 may need 234 lb. (5½ bushels). Some drills will not sow the latter quantity at one turn and in this connection it may be noted that the Aberdeen College experiments show a slight advantage in favour of broadcasting or cross drilling part of the seed, though this precludes horse hoeing. Where trouble from charlock may be expected, oats and barley should be drilled a little deeper than usual in order to allow of chain harrowing to destroy the weed seedlings. In the case of late-sown corn drilled deeply, much of the charlock can be killed by chain harrowing (after rolling) before the corn is up.

Oats after lea often receive insufficient harrowing at sowing time and the land consequently lies hollow. Rolling alone is not a good means of effecting the requisite consolidation; indeed, harm is often done by rolling young corn, the effect being to restrict the necessary access of air to the soil.

Winter Corn.—Wheat and winter oats usually require attention in March. Where the soil has been lifted and loosened by frost, rolling is in order; but the harrow should follow to make a loose surface mulch. On saddened land and especially where the crop looks somewhat yellow, the proper treatment is an application of nitrate and harrowing. Even land in good condition may bear a crop which looks " perished " in spring, the various life processes in the soil being retarded by deficient aeration. As a general rule corn should not be left to go through the summer with a flat-rolled surface.

Potato Culture.—In the milder and earlier districts planting begins in March. The earlies are put in and, if progress with the sowing of spring corn allows, the second earlies are also planted. In most districts, however, April is a better month for potato setting. Apart from the incidence of late frosts, the soil is generally too cold in March for this crop to make much development.

Potatoes are regarded as a cleaning crop, and this effect generally is produced by vigorous-topped kinds, such as new seed Kerr's Pink; but second earlies do not always leave the land clean. In these, particularly when left in the ground until autumn, any perennial weeds that survive till September spread rapidly after the crop has died down.

Some farmers plant second earlies as their main crop, for the reason that these kinds complete their growth in time to escape late " blight " which may catch late varieties in full growth. Here there is perhaps some excuse for curtailing the operations of cleaning before planting. Otherwise it is better to defer setting until all " twitch " and other running weeds have been extricated, in which work the spring tooth harrow renders great help; the eradication of perennial weeds by hoeing after planting is expensive, injurious to the crop and often unsatisfactory in the end. Potatoes, unlike mangolds, are not materially prejudiced by the land having been ploughed and deeply worked near the time of planting; but with this, as with all " green " crops, undue loss of soil moisture should be avoided.

MANURES FOR MARCH.

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High Grade Fertilisers.—It often happens that farmers have a choice of several alternative grades of the same class of artificial manure. High grade fertilisers save railway carriage and labour on the farm, and should certainly be chosen, in the absence of any definite reason to the contrary, if their unit prices are the same as those of the lower grades. Cases are frequent where the high grade manure is also the cheaper per unit. The following are recent values at London:—

Manure.		*Per cent.*	*Unit Value.*
Superphosphate	...	35	2/-
"	...	30	2/1
Potash Salts	...	30	2/6
"	...	20	2/7
Basic Slag	...	30	1/11
"	...	20–22	2/3

Six cwt. of 35 per cent. superphosphate contains the same amount of phosphate as 7 cwt. of the 30 per cent. grade; and 2 cwt. of 30 per cent. potash salts is the potash equivalent of 3 cwt. of the 20 per cent. salts; the economy in carriage and labour by using the higher grade fertiliser is therefore considerable.

Manures for Mangolds.—Mangolds make more demand on the soil than any farm crop, and therefore liberal treatment is necessary to obtain a good yield and keep the land in condition. Dung is the best basis for the mangold manure, and about 15 tons per acre helped out with a suitable mixture of artificial fertilisers is usually as effective as double the quantity of dung used alone.

Nitrogen is the next main requirement of the crop. This may be given as 1·2 cwt. per acre of sulphate of ammonia before drilling, or as two top dressings each of 1 cwt. per acre of nitrate of soda, one applied when the crop is singled and the other about five weeks later.

Although the dung will supply a large amount of potash, the mangold crop benefits from a further potash dressing. For this purpose the crude potash salts are especially suitable as they supply common salt in addition to the potash, which itself is purchased at the cheapest unit rate in such combination. If sulphate of ammonia is to be the source of nitrogen, 4 cwt. per acre of 12½ per cent. kainit or its equivalent of other salts would be a useful dressing. If nitrate of soda is to be used the potash might well be reduced to one half the above, unless it was known that the soil was particularly dependent on potash dressings.

Superphosphate is a suitable form in which to supply the necessary phosphate before drilling, though if the phosphate can be applied early in the year, equivalent basic slag or steamed bone flour could be used. About 4 cwt. per acre of superphosphate would be a usual dressing, but poor clays and fen soils will respond to larger applications.

Salt is sometimes used for mangolds, being applied with the nitrate of soda as a top dressing. Since, however, the potash salts will provide roughly half their weight of common salt, the need for a special application of salt is not so great now as before the general adoption of these sources of potash.

Sugar-Beet.—Increasing attention is being given to this crop, and inquiries are often made as to its manurial treatment. This is much the same as for mangolds, but since the yield per acre of beets is only about one-half that of mangolds, while more importance is attached to the quality of the roots as measured by their sugar content, the manuring of the two crops differ in minor points. Dung should be used only in moderate quantities; the heavy dressings often employed for mangolds are unnecessary; and the manure should be applied at such a time as to allow rotting to take place before the seed is sown. Fresh dung causes the roots to fang in the soil, and this is objectionable on account of the large amount of soil which has to be removed at the factory. Heavy top dressings of nitrogenous manure are to be avoided as they tend to produce coarse roots and too much leaf growth, and to delay ripening. The following is a manurial scheme suitable for ordinary loams (quantities per acre):—

10 tons dung applied in winter or as early as possible in spring.
4 cwt. superphosphate (or its equivalent of basic slag applied earlier).
¾ cwt. sulphate of potash (or its equivalent of other salts).
¾ cwt. sulphate of ammonia.

The above fertilisers may be mixed, broadcast, and worked in while preparing the land for drilling. When the crop is singled a top dressing of 1 cwt. per acre of nitrate of soda will be required, and about six weeks later a further dressing of the same amount may be given if the crop appears to need it.

Shortage of Dung.—Market gardeners and farmers on the outskirts of towns who rely on large quantities of town stable manure to grow vegetable crops are finding it increasingly difficult to obtain sufficient dung for their requirements. How far town stable manure could be supplemented or replaced by a mixture of artificial fertilisers for market garden crops was investigated by Dyer and Shrivell over the years 1904-13 on a rather poor clay loam in Kent. Their results are of increasing importance as the shortage of dung becomes more acute. Some of the figures for cabbage and kindred crops have been reduced to a comparative basis and are quoted below.

Manures per acre applied each season	Autumn cut cauliflowers (13 seasons)	Broccoli (12 seasons)	Savoy cabbages (13 seasons)	Spring cabbages (12 seasons)	Brussels sprouts (12 seasons)
25 tons London dung	100	100	100	100	100
12½ ,, ,, ,,	82	87	83	92	74
12½ tons London dung + 6 cwt superphosphate + 2 cwt. nitrate of soda	103	99	102	100	95
Do. + 4 cwt. nitrate of soda	115	108	113	106	105
Do. + 6 cwt. nitrate of soda ...	121	113	113	111	110
No dung. 6 cwt. superphosphate, 8 cwt. nitrate of soda ..	98	104	105	103	98
Do, + 1 cwt. sulphate of potash	114	114	112	111	102

These yields are expressed as percentages of those obtained with 25 tons of dung per acre and are averages taken over the 12 or 13 years of experiment. The crops were not grown continuously on the same land, but were taken in rotation of market garden crops. It will be seen that 12½ tons of dung supplemented with a light dressing of artificials was about as effective as 25 tons of dung; and that each increase in the nitrate supply was reflected in the yield. The inclusion of 1 cwt. of sulphate of potash in the artificial mixture was particularly effective in the absence of dung. A complete and heavy dressing of artificials was more effective than 25 tons of dung over the 13-year period; while the mixtures of artificials with 12½ tons of dung cost less than the heavy dressing of dung and gave bigger crops. Nitrogen was supplied as nitrate of soda; phosphate as superphosphate and as basic slag in alternate years, and potash as sulphate of potash. It is probable that equivalent quantities of alternative forms of artificials (such as sulphate of ammonia, steamed bone flour, potash salts, etc.) if used in accordance with their special properties would give results of a similar character.

Potash Manures.—The less concentrated potash manures, such as kainit, potash manure salts, and sylvinite, which contain in addition to muriate of potash considerable amounts of common salt and in some cases salts of magnesia as well, are valuable sources of potash. At this season of the year they deserve special attention as constituents of the mangold manure since the salt they contain is of special value to this crop, while the potash itself is also purchased at a relatively cheap rate. They are put on the market in various grades each guaranteed to provide a definite minimum percentage of pure potash. The best known salts contain 12½ per cent., 14 per cent., 20 per cent. and 30 per cent. of potash. The potash content must be borne in mind both in relation to the price per ton (*i.e.*, the unit value of potash in the form in question) and also in deciding how much of the particular manure to employ in a dressing. Thus, if the mangolds were to have 5 cwt. of 12½ per cent. kainit the rough equivalent of potash supplied in the other grades would be 4½ cwt. of 14 per cent., 3 cwt. of 20 per cent., or 2 cwt. of 30 per cent. salts. For crops other than mangolds and grass, where common salt is not specially required, there is something to be said in favour of purchasing the more concentrated of these salts with a view to saving railway charges and handling costs.

A Mixed Fertiliser.—Gardeners and allotment holders often require a complete artificial mixture which will serve to keep the soil in good condition as far as plant food is concerned. A suitable mixture of this kind would be :—

2 cwt. sulphate of ammonia providing in the mixture 5% nitrogen.
4 „ superphosphate „ „ „ 15% soluble phosphate.
1 „ steamed bone flour „ „ „ 7% insoluble phosphate.
1 „ sulphate of potash „ „ „ 6% pure potash.

The constituents could be purchased co-operatively by allotment associations and divided into small lots after thorough mixing. Applications may be made in spring at about 8 cwt. per acre or 5½ lb. per square rod to help out a light dressing of stable manure; or in the absence of dung the dressing could be increased to 12 cwt. per acre or 8 lb. per square rod. Such treatment would form a good basis for most vegetable crops, but cabbages and root crops would benefit by one or two top dressings of nitrate of soda or sulphate of ammonia at about 1 cwt. per acre or ¾ lb. per square rod in addition to the mixture. Applications of quicklime or ground limestone once every three or four years will be necessary on soils not naturally rich in chalk to obtain the best results from artificial fertilisers.

Artificial Farmyard Manure.—As a result of the recent outbreak of foot-and-mouth disease certain farmers, who have had their cattle slaughtered and are prevented from re-stocking their farms, find themselves with large quantities of straw on hand which they cannot convert into dung. In these circumstances, and particularly if a good supply of water is available, the process of rotting straw by chemical treatment, worked out by Hutchinson and Richards at Rothamsted, might meet the case.

Results of a trial on oats with artificial farmyard manure made on a farm in Romney Marsh have recently been published by G. H. Garrad, the County Agricultural Organiser for Kent. The quantity of straw converted was 82 tons, and about three months was required for rotting to take place. The treatment and yields of oats were:—

Plot.	*Manures per acre.*	*Oats. Bus. per acre.*
1	15 tons of artificial F.Y.M. in December + artificials at sowing time ...	54
2	21 „ „ bullock dung in December (no cake fed)	46
3	15 „ „ artificial F.Y.M. in December (no artificials)	50
4	Chaffed straw in December + chemicals at sowing time (chalk and sulphate of ammonia)	34

The dressings on Plots 1 and 2 were arranged to supply the same amounts of plant food per acre. Plot 4 received such straw and chemicals per acre as would produce 15 tons of artificial farmyard manure if rotted in the stack.

The figures indicate that straw when rotted artificially under proper conditions had in this case a fertilising value which compared favourably with that of dung made without cake. That the rotting is essential is seen by the failure of Plot 4.

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending February 6th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	14. 5	13.15	13.10	13.10	17. 5
,, ,, Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	14. 0*	14. 0*	14. 0*	14 0.*	(N)13. 6
,, ,, ,, neutral (A. 25¾ per cent.)	15. 3*	15. 3*	15. 3*	15. 3*	(N)14. 3
Kainit (Pot. 12½ per cent.)	...	..	...	2. 5	3. 7
,, (Pot. 14 per cent.)	2.10	2. 6*	2. 5	2.10	3. 7
Sylvinite (Pot. 20 per cent.)	...	...	...	2.15	2. 9
Potash Salts (Pot. 30 per cent.)	...	..	...	3.15	2. 6
,, ,, (Pot. 20 per cent.)	...	...	...	2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 5	7.10	7. 7	2.11
Sulphate of Potash (Pot. 48 per cent.) ...	..	...	11. 5	11. 5	4. 8
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
,, ,, (T.P. 30 per cent.) ...	...	...	...	2.17§	1.11
,, ,, (T.P. 26 per cent.)	2.13§	2. 0§	...	...	..
,, ,, (T.P. 24 per cent.)	2. 9§	1.16§	2. 0§	...	...
,, ,, (T.P. 20-22 per cent.)	...	1.13§	.	2. 5§	2. 3
,, ,, (T.P. 18 per cent.)	2. 3§	...	1.15§	..	...
Superphosphate (S.P. 35 per cent.) ...	3.19	...	3.10§	3.10	2. 0
,, (S.P. 30 per cent.) ...	3.12	3. 7	3. 8§	3. 2	2. 1
Bone Meal (A. 4½. T.P. 45 per cent.) ...	9.10	8. 5	8.15	8. 5	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6.10	6. 7†	6. 5	6. 2†	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	...	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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MONTHLY NOTES ON FEEDING STUFFS.

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The Nutritrive Value of Sunflower Seed Cake and Meal.—With the reopening of trade with Russia, a certain amount of sunflower seed cake and meal is now reaching the English market, and the writer has already had a sample submitted to him for opinion. In Russia, sunflowers are cultivated as a field crop on a fairly extensive scale. The oil is extracted and used for culinary purposes, the residual oil cake or meal being used for cattle feeding.

Composition.—The nutritive value of sunflower seed cake varies considerably with the degree of decortication and the extent to which the oil has been extracted. A meal that has been obtained from the undecorticated seed by a solvent process is of little value as a feeding stuff, and may possess as much as 36 per cent. of woody fibre and as little as 2 per cent. of oil. On the other hand, a cold pressed cake obtained by crushing decorticated seed contains as much as 12 per cent. of oil and closely approximates to linseed cake in nutritive value. Samples of cake or meal varying between these extremes may find their way on the market, and in attempting to assess their value for feeding purposes, readers are advised to ascertain the percentage of woody fibre as well as the oil and albuminoids before purchasing. The following figures represent an average analysis of samples of decorticated and undecorticated sunflower cake respectively (per cent.) :—

							Digestible Nutrients.			
	Dry Matter.	*Protein.*	*Oil.*	*Soluble Carbo-hydrates.*	*Fibre.*	*Ash.*	*Prot.*	*Oil.*	*Carbo.*	*Fibre.*
Sunflower Cake, decorticated	90·4	37·4	13·8	20·4	12·1	6·7	33·6	12·2	14·6	3·6
Sunflower Cake, undecorticated	92·9	19·1	7·4	28·9	30·0	7·5	17·2	6·5	20·6	5·3

Both the above cakes represent samples obtained by the cold press method. Extracted sunflower seed meal will be still less valuable than undecorticated sunflower cake. The starch equivalent of the decorticated cake is 72.5, that of the undecorticated 49.5. The nutritive ratios are, respectively, 1 : 1 and 1 : 2.

Use of Sunflower Seed Cake for Livestock.—A typical sample of sunflower seed cake is hard in texture, and generally contains some earthy matter and weed seeds. Its keeping qualities are good, there being little danger of rancidity occurring during storage. The best samples of sunflower seed cake may be freely used with all classes of stock, but its use is not advocated for pigs, particularly fattening pigs. If pigs are fattened on a ration containing sunflower seed cake a soft quality of pork is produced. Sunflower seed cake is, however, suitable for cows, feeding to which has been followed by an increase in the fat in the milk from cows fed with it. It is also a good feeding stuff for fattening cattle and sheep, the quality of the resultant carcass being favourably influenced by its use.

In the case of working horses, it has been shown to be of value as an oat substitute.

DESCRIPTION.	Price per Qr.		Price per		Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
	s. d.	lbs.	Cwt. s. d.	Ton. £ s.	£ s.	£ s.		s.	d.
Wheat, British	—	—	11/-	11 0	0 16	10 4	71·6	2/10	1·52
Barley, British Feeding	—	—	10/6	10 10	0 12	9 18	71	2/9	1·47
„ Canadian No. 4 Western	37/6	400	10/6	10 10	0 12	9 18	71.	2/9	1·47
Oats, English, White	—	—	11/-	11 0	0 14	10 6	59·5	3/6	1·87
„ „ Black and Grey	—	—	9/8	9 13	0 14	8 19	59·5	3/-	1·61
„ Scotch, White	—	-	11/4	11 7	0 14	10 13	59·5	3/7	1·92
„ Canadian No. 2 Western	28/0	320	9/10	9 17	0 14	9 3	59·5	3/1	1·65
„ „ No. 3 „	26/9	„	9/4	9 7	0 14	8 13	59·5	2/11	1·56
„ Canadian Feed	25/0	„	8/9	8 15	0 14	8 1	59·5	2/8	1·43
„ Argentine	24/0	„	8/5	8 8	0 14	7 14	59·5	2/7	1·38
Maize, American	43/3	480	10/2	10 3†	0 13	9 10	81	2/4	1·25
„ Argentine	45/0	„	10/6	10 10	0 13	9 17	81	2/5	1·29
„ South African	43/3	„	10/2	10 3†	0 13	9 10	81	2/4	1·25
Beans, English Winter	—	—	11/-	11 0	1 13	9 7	67	2/9	1·47
„ Rangoon	—	—	8/9	8 15†	1 13	7 2	67	2/1	1·12
Peas, Japanese	—	—	24/	24 5†	1 9	22 16	69	6/7	3·53
Millers' Offals:—									
Bran, British	—	—	—	7 17	1 7	6 10	45	2/11	1·56
„ Broad	—	—	—	8 15	1 7	7 8	45	3/3	1·74
Middlings Fine (Imported)	—	—	—	10 2	1 3	8 19	72	2/6	1·34
„ Coarse (British)	—	—	—	9 2	1 3	7 19	64	2/6	1·34
Meal, Barley	—	—	—	11 7	0 12	10 15	71	3/0	1·61
„ Maize	—	—	—	11 5	0 13	10 12	81	2/7	1·38
„ „ South African	—	—	—	10 5	0 13	9 12	81	2/4	1·25
„ „ Germ	—	—	—	10 5	0 19	9 6	85·3	2/2	1·16
„ „ Gluten-feed	—	—	—	9 5	1 8	7 17	75·6	2/1	1·12
„ Locust Bean	—	—	—	8 5	0 10	7 15	71·4	2/2	1·16
„ Bean	—	—	—	12 15	1 13	11 2	67	3/4	1·78
„ Fish	—	—	—	20 0	4 8	15 12	53	5/11	3·17
Linseed	—	—	—	23 10	1 12	21 18	119	3 8	1·96
„ Cake, English 9°/ₒ Oil	—	—	—	13 7	1 19	11 8	74	3/1	1·65
Cottonseed Cake, English 5½°/ₒ Oil	—	—	—	7 15	1 16	5 19	42	2/10	1·52
„ „ Egyptian 5½°/ₒ Oil	—	—	—	7 12	1 16	5 16	42	2/9	1·47
Decorticated Cotton Seed Meal 7% Oil	—	—	—	13 7	†2 16	10 11	71	3/0	1·61
Coconut Cake 6°/ₒ Oil	—	—	—	10 2	1 11	8 11	73	2/4	1·25
Palm Kernel Meal 2°/ₒ Oil	—	—	—	6 10	1 5	5 5	71·3	1/6	0·80
Feeding Treacle	—	—	—	7 0	0 8	6 12	51	2/7	1·38
Brewers' Grains:—									
Dried Ale	—	—	—	8 7	1 5	7 2	49	2/11	1·56
„ Porter	—	—	—	7 17	1 5	6 12	49	2/8	1·43
Wet Ale	—	—	—	1 15	0 9	1 6	15	1/9	0·94
„ Porter	—	—	—	1 10	0 9	1 1	15	1/3	0·76
Malt Culms	—	—	—	7 12	1 15	5 17	43	2/9	1·47

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of January and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 11s. per ton. The food value per ton is therefore £8 9s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 6d.; P_2O_5, 4s. 1d.; K_2O, 2s. 6d

Quantities to use.—Fattening cattle have been given up to 14 lb. per head per day, pigs 2-4 lb. a day, fattening sheep 8 oz., and working horses may be given up to 6 lb. per head per day. The quantities here given refer to the best quality cake; much more care should be exercised in feeding the undecorticated cake or extracted meals. Since the digestibility decreases rapidly with the increase in woody fibre the undecorticated samples are relatively less valuable as feeding stuffs than the decorticated samples, on a comparative analytical basis.

FARM VALUES.

CROPS.	Market Value per lb. S.E.	Value per unit S.E.		Starch Equivalent per 100 lb.	Food Value per Ton.		Manurial Value per Ton.		Value per Ton on Farm.	
	d.	s.	d.		£	s.	£	s.	£	s.
Wheat	1·25	2	4	71·6	8	7	0	16	9	3
Oats	1·25	2	4	59·5	6	19	0	14	7	13
Barley	1·25	2	4	71·0	8	6	0	12	8	18
Potatoes	1·25	2	4	18·0	2	2	0	4	2	6
Swedes	1·25	2	4	7·0	0	16	0	2	0	18
Mangolds	1·25	2	4	6·0	0	14	0	3	0	17
Good Meadow Hay	1·56	2	11	31·0	4	10	0	14	5	4
Good Oat Straw	1·56	2	11	17·0	2	10	0	7	2	17
Good Clover Hay	1·56	2	11	32·0	4	13	1	1	5	14
Vetch and Oat Silage	1·43	2	8	14·0	1	17	0	7	2	4

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Poultry Breeding Experiments.

THE Ministry has now received Treasury authority to carry out at the Reaseheath School of Agriculture, Nantwich, Cheshire, practical experiments in the breeding of laying poultry with a view to obtaining information as to the effect, if any, upon the inheritance of laying qualities of certain forms of in-breeding and out-breeding practised at present by North of England breeders. Details of these experiments are as follows:—

1. To test experimentally the effect of *in-breeding* on fecundity in certain selected strains of pure-bred fowls, by mating together brother and sister, dam and son, sire and daughter, dam and grandson, etc., the relative fecundity of the progeny to be carefully recorded.
2. To test the effect of *out-breeding* on fecundity in certain selected strains of pure-bred fowls.
3. Concurrently with experiments 1 and 2, to make observations on the strains employed, in order to obtain evidence on the question whether there is or is not a linkage between the external characters and fecundity.
4. Concurrently with experiments 1 and 2, to record any data bearing on the possibility of building up a strain of pullet breeders.

These experiments will constitute part of the National Poultry Institute Scheme, and a Sub-Committee of the Ministry's Poultry Institute Advisory Committee is responsible for the carrying on of the experiments. The members of the Sub-Committee were nominated by the National Poultry Council and consist mainly of practical poultry breeders, with Professor S. J. Hickson, M.A., D.Sc., F.R.S., of Manchester University as chairman.

The Sub-Committee proposes to use as a foundation stock, breeding pens of 6 hens and 1 cockerel of each of the following three breeds, viz., White Leghorn, Rhode Island Red and White Wyandotte, wtih the provision of a duplicate pen in each case. The hens in each pen will consist of three good layers and three poor layers whose breeding and individual trap-nest records are known.

For the purpose of the experiments, the Cheshire County Council will provide land at the Reaseheath Farm Institute, and other facilities, free of charge, and the work will be conducted in close association with the staff of the Cheshire Education Authority.

The capital expenditure involved under the Scheme up to the 31st March next is estimated at £1,500. This figure covers the cost of a portable bungalow for the resident poultryman, a food store, incubating house and office, as well as the poultry houses and equipment required up to that date. The capital expenditure for the ensuing twelve months up to the 31st March, 1925, is estimated at £800. One-fourth of the capital expenditure will be provided out of the funds contributed by the poultry industry towards the National Poultry Institute Scheme, the remaining three-fourths being provided by the Ministry of Agriculture out of the Development Fund. Maintenance expenditure, mainly on feeding stuffs, wages and fuel, is estimated for the twelve months ending 31st March, 1925, at £715. The whole cost of maintenance will be borne by the Development Fund.

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Instruction in Milk Recording.

ARRANGEMENTS have been made with the authorities of the Midland Agricultural College to hold a course of instruction in Milk Recording, from 28th April to 17th May, 1924, provided that a sufficient number of students apply for admission. A syllabus showing full particulars of the course may be obtained on application to the Principal, Midland Agricultural

College, Sutton Bonington, Loughborough. The course includes lectures on milk—its nature and composition, bacteria and their relation to milk, testing of milk, and the principles and practice of milk recording; and practical work on actual milk recording of a comprehensive character, including food records, cost of foods, and cost of food per gallon of milk. The tuition fee will be £3 3s. Board may be obtained at the Sutton Bonington Hostel (30s. per week). The registration fee for the period is 5s.

Application for admittance to the course should be made on or before 18th April. Preference will be given to students who are either already milk recorders under the Ministry's scheme or who intend to apply for such posts. It is not possible to give any indication as to what vacancies for milk recorders may arise, nor can any guarantee be given that students will in fact obtain employment as milk recorders. The names of successful students will, however, be circulated by the Ministry to all milk recording societies in order that preference may be given by societies to these students on the occasion of filling a vacancy. The appointments carry salaries ranging usually from £150 to £250 per annum, and they afford to young agriculturists an excellent opportunity of acquiring a practical knowledge of dairy farming, often of the best type, as carried out on a variety of farms.

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Trials of Potatoes for Immunity from Wart Disease, 1923.*

THE trials which are conducted by the Ministry each year with the object of testing new varieties of potatoes as to their immunity from wart disease were again carried out in 1923 on the farm of the National Institute of Agricultural Botany, at Ormskirk, Lancashire. The actual field operations and the taking of records were carried out by Mr. Harold Bryan, B.Sc., and Miss Whitehead, of the Institute, but the trials were conducted on a plan approved by the Ministry.

The results of the trials have been considered by a small Committee composed of representatives of the Ministry of Agriculture and Fisheries, the Board of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland.

The findings of the Potato Synonym Committee of the

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* For the results of the 1922 trials, see this *Journal*, March, 1923, p. 1134

National Institute of Agricultural Botany have been accepted where recommendations as to the classification of varieties as synonymous with existing varieties have been made by that Committee.

After full consideration of the results of the 1923 trials, 18 new varieties have been added to the list of those approved as immune from wart disease, and descriptions of these varieties are appended hereto. In addition to those included in this list 31 varieties successfully passed the test; the growers, however, do not propose to place these varieties on the market at the present time, and their inclusion in the approved list is therefore postponed with the object of restricting the list to those varieties which have actually been introduced into commerce.

New Approved Immune Varieties.—The following are the descriptions of those varieties of potatoes which have been added to the Ministry's list of varieties, approved as immune from wart disease as the result of the 1923 trials:—

Early Varieties:—

Balcarres.

Tubers—round; skin white; flesh white, eyes medium.

Haulm—upright, strong, vigorous, medium height, leaflets medium size, medium green; stems green; wings knife-edged. Leaf very open.

Flowers—white; anthers dark yellow.

Second Early Varieties:—

The Massie.

Tubers—round; skin white; flesh deep yellow; eyes medium.

Haulm—erect to spreading, irregular; leaflets light yellow green, narrow, elongated; stems light green; wings slightly serrated.

Flowers—white.

Wild Rose.

Tubers—oval, flat; white skin; shallow eyes, white flesh.

Haulm—spreading; leaflets light yellow green, glossy, heart shaped; stem bronzed; wings much serrated.

Flowers—white with bluish tint, very distinct; anthers orange.

Late or Maincrop Varieties:—

Avondale.

Tubers—kidney; skin white; flesh pale lemon; eyes shallow.

Haulm—tall, upright, vigorous; leaflets small, dull; stems much bronzed, numerous; wings serrated; leaf open.

Flowers—white; anthers yellow.

Beauty of Bute.

Tubers—round; skin white, speckled pink specially in the eyes, ping blush at heel end of tuber; eyes medium to deep; flesh white.

Haulm—tall, erect to spreading; leaflets glossy, medium green, corrugated; leaf open; stem much bronzed; wings straight.
Flowers—heliotrope, tipped white.

Benalt.
Tubers—round; skin white; traces of pink in the eyes; flesh lemon; eyes shallow.
Haulm—upright, regular, vigorous; leaflets grey-green; flat; stems green, serrated wings; open leaf.
Flowers—none observed, buds drop.

Buchan Beauty.
Tubers—round, dented at stem end; skin yellow with blue purple splashes; flesh yellow; eyes deep; sprouts blue purple.
Haulm—tall, upright; stems thick, branching freely, mottled blue purple especially at base; leaf open; midrib often has a spot of purple at the base and at the base of the leaflet stalk; leaflets small, round, medium to dark green, margins fluted, veins well marked, giving the leaflet a slightly crinkled appearance; secondary leaflets small, but fairly numerous.
Flowers—dark blue purple tipped white, profuse.

Dundarave.
Tubers—kidney to oval; skin white; flesh pale lemon; eyes shallow.
Haulm—spreading; leaflets light green, glossy, flat.
Flowers—creamy white, numerous.

Early Manistee.
Tubers—oval, flattish; skin uniformly red; eyes shallow and on the point; flesh white.
Haulm—bushy, somewhat spreading; leaflets small, dull, corrugated, rigid; leaf open; stem light green; wings serrated.
Flowers—white.

Edinchip.
Tubers—kidney to oval; skin white; flesh pale lemon; eyes shallow.
Haulm—spreading; leaflets light green, glossy flat.
Flowers—white, very seldom formed.

Footprint.
Tubers—round, skin white; flesh pale lemon; eyes shallow.
Haulm—upright.
Flowers—white, anthers orange.

Golden Marvel.
Tubers—oval, skin white; flesh yellow; shallow eyes.
Haulm—upright, strong, tall; leaflets dark, glossy, cup-shaped; stems bronzed, stout; wings slightly serrated.
Flowers—white with blue blush.

Keay's Champion.
Tubers—oval, skin white mottled pink, especially in heel; flesh pale lemon; eyes medium.
Haulm—spreading; leaflets light green, soft, heart shaped; numerous green stems; wings straight.
Flowers—white; anthers orange.

Liddesdale Lad.
Tubers—oval; skin pink; sprouts pink; flesh pale yellow; eyes saucer-shaped and on the point.

Haulm—habit tall; stem branching, markedly pink, with green wings. Leaf open, with pink midrib. Leaflet dull, dark green and hairy; bases of young leaflets markedly red purple when young; veins well marked; stalks red purple.

Flowers—white, profuse; buds red purple; stalks short and red purple; berries profuse.

Main's Surprise.

Tubers—oval; skin white; flesh pale lemon; eyes shallow.

Haulm—upright, medium height; leaflets medium size, elongated; stems very slightly bronzed; wings slightly serrated.

Flowers—white, rare, buds dropping.

Royal Stewart.

Tubers—kidney; skin white; flesh white; eyes shallow.

Haulm—upright, strong; leaflets light green, heart shaped, crinkled; stems stout, bronzing in the axils of the leaves; leaf open.

Flowers—white, small

Scottish Chief.

Tubers—round; skin white; flesh white, eyes shallow.

Haulm—upright; leaflets medium green, crinkled, cup shaped; stem slight bronzing; wings markedly serrated.

Flowers—white, rare.

Spion Cop.

Tubers—round; skin white; flesh lemon; eyes medium.

Haulm—upright, bushy; leaflets medium green, elongated, glossy, crinkled; stems numerous; wings straight.

Flowers—white, rare.

Note.—The variety "Clifden Seedling" added to the list after the 1922 trials (see this *Journal*, March, 1923, p. 1137) has now been declared by the Potato Synonym Committee of the National Institute of Agricultural Botany to be synonymous with "Champion II," under which name it will in future be shown in the Ministry's list.

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Sheep Breeding Research.

A REPORT* on wool improvement has been published by the British Research Association for the Woollen and Worsted Industries. "Torridon," Headingley, Leeds. It is issued by the Joint Committee on Sheep Breeding which consists of representatives of the Association, the Universities of Leeds, Edinburgh and North Wales, the University College, Reading, Armstrong College, Newcastle-upon-Tyne, sheep breeders, and the Agricultural Departments of England, Scotland and Ireland.

The report describes a scheme for wool improvement which was proposed by the University College of North Wales, and is being carried out in close co-operation between the College and the Animal Breeding Research Department, Edinburgh, where a farm for breeding operations will be taken. Microscopic examination has been made of the various types of fibres, and the development of the fleece is being watched from birth to maturity with a close regard for manufacturers' requirements. Particular attention is being given to conditions which promote or destroy "kemp" or "red kemp" in different flocks, while a number of cross breeding experiments are in progress.

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* Publication No. 29.

The results of the first miscroscopical study of fleeces were published in the *Journal of the Textile Institute*, Vol. 13, No. 7, 1922; those of the second and third are given in the present report. They deal with the wild variety and with the adult Blackface fleece.

A number of rams and ewes of pure Merino blood have been given by the State Farms of Peru, and experiments in breeding this type are being conducted. A large range of Merino stud sheep fleece samples have been obtained from Australia and are being examined, and comparative tests with existing sheep-marking materials are also being conducted.

The work of the Committee is of great interest to both breeders and manufacturers, and the Report deserves the closest attention of all interested.

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Allotments Advisory Committee.

THE Minister of Agriculture has appointed Mr. Walter R. Smith, M.P., Parliamentary Secretary to the Ministry, to be Chairman of the Allotments Advisory Committee. This Committee was set up on the recommendation of the Departmental Committee on Allotments which reported in 1922, and that it is in the nature of a Standing Committee consisting of representatives of the Central Land Owners' Association, the Parliamentary Allotments Committee, the County Councils' Association, the Association of Municipal Corporations, the Urban District Councils' Association, the Land Union, the Agricultural Organisation Society, and the National Union of Allotment Holders, which advises the Ministry upon allotment matters.

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Foot-and-Mouth Disease.—*Committee of Investigation.*—The Minister has decided to appoint a small Committee to examine into the circumstances of the recent outbreak of foot-and-mouth disease, to review and report upon the slaughter policy and the procedure adopted by the Ministry, to advise whether any further precautions should be taken to guard against the introduction and spread of the disease, and to consider whether a scheme of insurance can be devised as an alternative to the existing system of compensation for slaughtered animals.

The Committee will consist of the Right Hon. E. G. Pretyman (Chairman), Mr. Walter Smith, M.P., Parliamentary Secretary to the Ministry of Agriculture, Mr. H. German, and Mr. Alexander Batchelor.

Position on 21st February, 1923.—The position in regard to foot-and-mouth disease has remained stationary during February. The outbreaks during the first four days of the week ended 23rd February, however, show a tendency to an increase. It will be remembered that the disease reached its height in December, when 1,261 premises were found to be infected. The figures of outbreaks for the last eight weeks are 319, 256, 193, 115, 57, 57, 63, and 55 respectively. New centres of disease have, however, appeared during February in Essex, Ayr, Notts, Hunts, and Kent.

Since the commencement of the present series of outbreaks on the 27th August, 1923, the numbers of infected premises declared and animals slaughtered and the expenditure incurred up to 21st February have been:—

Total number of outbreaks in Great Britain - - - -				2,664
Number of counties affected - - -		35 in England 2 in Wales and 11 in Scotland		
Total number of animals slaughtered or authorised to be slaughtered	Cattle.	Sheep.	Pigs.	Goats.
to be slaughtered - -	90,940	30,797	42,454	115
Percentage of animals slaughtered to total animal population of Great Britain - - - -	Cattle. 1·3	Sheep. 0·15	Pigs. 1·5	
Estimated Gross Compensation payable for animals slaughtered - - -		£2,901,000		
Estimated receipts for salvage of healthy carcases -		£383,600		

On the 8th February the Ministry issued an Order operating as from the 18th February, the effect of which was materially to reduce the extent of the areas subject to restrictions. Some important amendments have been made in the regulations controlling the movement of animals in infected areas, viz.:—

(1) Animals which are moved from one farm to another in an infected area or from premises outside any infected area to premises in such an area, otherwise than for breeding purposes, are required on arrival at the place of destination to be detained thereon for a period of 28 days;

(2) For the purposes of licensing movements or of authorising the holding of sales of animals whether at fat stock markets

or on farm premises, any infected place may be disregarded at the expiration of 28 days from the date upon which the slaughter of all stock thereon was completed, provided that in the meantime the final disinfection of the premises has been completed to the satisfaction of an Inspector of the Ministry; and

(3) In the case of sales of animals on farm premises the Local Authority may authorise sales on any such premises which are not within 2 miles of an infected place instead of within 5 miles. The distance of 5 miles is still applicable in the case of fat stock markets.

Sale of Seeds other than Cereals.—The Seeds Act, 1920, makes it compulsory in the case of a sale of any of the principal kinds of grass, clover, field or garden seeds for the seller to state in writing certain essential particulars as to their quality, such as the percentage of germination, percentage of purity, presence of injurious weed seeds, country of origin, etc. Similarly, in the case of a sale of seed potatoes, particulars must be given as to the country of origin, variety and size.

These particulars must be delivered to the purchaser at or before the time of sale or delivery of the seed, except in the case of wheat, oats, rye and barley for seed, when, by virtue of a general licence issued by the Ministry of Agriculture, the necessary particulars may be delivered at any time within one month of the sale.

Paragraphs have appeared in the Press which suggest that the general licence authorising delay in the delivery of the particulars applies to all classes of seed covered by the Act. It should, however, be clearly understood that it relates solely to the cereal seeds mentioned above.

Seed Potatoes: Regulations for Sale.—The Ministry has prepared a memorandum which gives, in a very concise form, the particulars that are required by the Seeds Act, 1920, the Seeds Regulations, 1922, and the Wart Disease of Potatoes Order, 1923, to be declared in respect of sales of seed potatoes. This memorandum is being widely circulated and will, it is believed, prove of assistance to sellers of seed potatoes when the spring sales commence. Copies may be obtained from the Ministry, 10, Whitehall Place, London, S.W.1.

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NOTICES OF BOOKS.

The Manuring of Grass Land for Hay.—(Winifred E. Brenchley, D.Sc. London: Longmans, Green & Co., price 12s. 6d.) Is one of the series of Rothamsted Monographs on Agricultural Science. In 1856 Lawes and Gilbert laid out the Park Grass Plots to determine the relative effect of different combinations of manures upon hay production with reference not only to yield but to the botanical composition of the herbage, and they eventually published the results of 20 years' continuous manuring. Dr. Brenchley has collated the additional data which have accumulated since then, and by dint of compression and tabulation of masses of facts and figures has succeeded in presenting the salient features in an interesting and highly instructive form.

The authoress is careful to point out that the results deal solely with the Rothamsted plots on heavy soil and that, with certain exceptions, the same manuring has been applied to each plot up to the present day; further, that the first crop of grass has been cut for hay every year, and, since 1872, the aftermath as well. While, therefore, from the scientific point of view, the value of the work lies to a great extent on the length of time over which the experiments have been carried on, farmers must take into consideration the fact that the continuous use of the same manures and of the same method of crop utilisation is not in accord with general practice. What the farmer will want to know is whether, in the ordinary way, it will be possible to attain the most desirable combination of plants.

Of the more striking results set out, one of the most interesting is the beneficial effect on Meadow Foxtail—a very early and valuable grass—of a plentiful supply of nutrients. It seems to need abundance of nitrogen, either in "artificial" or organic form, in a soil not too acid from lack of lime. As regards *Agrostis* (Bent, Twitch, etc.) it is found not to be encouraged by superphosphate nor by heavy dressings of nitrogenous manures with minerals, and is actively discouraged by liming. On the other hand, it is encouraged by organic manures.

Of the few leguminous plants found in the herbage, it is stated that Red Clover and Birdsfoot Trefoil are most in evidence under starved conditions and where minerals have been used—a finding not in disaccord with everyday experience.

Farmers as well as academic workers should find much food for thought in this admirably arranged and skilfully summarised record of experimental work.

Kohlensäure und Pflanzenwachstum.—(Bornemann, F. 2nd Edition, pp. 138. Berlin: Paul Parey, 1923.) This is a second edition of a book originally published in 1919. The writer points out in the preface how the three intervening years have tended to confirm the arguments of the earlier edition. No one now doubts, he says, that cultivated plants give higher yields when they receive an increased supply of carbon dioxide. A few of the old opponents still fight a rearguard action with the contention that it is impossible to provide this increased supply of carbon dioxide to crops in the open field. The book covers the whole question of the assimilation of carbon-dioxide frm air, soil and manure, and an account is given of experiments with increased supply, both in plant houses and in the open air.

The Potato.—(William Stuart. Philadelphia and London: J. B. Lippincott Company. 518 pp. Price 12s. 6d. net.)—In the preparation of this book it has been the aim of the author to discuss the basic principles underlying the production of potatoes, as well as to include the latest available information in regard to the American potato industry as a whole. Chapters are included dealing with the original potato of South America, the history of its introduction and spread in Europe, and finally its introduction into the United States from Ireland in the eighteenth century.

Though this volume deals primarily with potato growing in the United States, and cannot fully apply in this country, where conditions are materially different, yet the fundamental principles underlying production are the same. It can be recommended to all agriculture students in this country.

The author has long been a well-known authority on potato breeding and potato selection, and in Chapter xxi he gives the results of his experience and conclusions as only a master of his subject can give.

Perhaps, however, the chapter on classification will be the most appreciated by European readers, because of the detailed and thorough way in which the descriptions of each commercial variety has been dealt with and illustrated with coloured plates showing sprouted tubers and blossoms.

The whole book is abundantly illustrated with photographs and text figures.

Grassland Farming.—(W. J. Malden. London: Ernest Benn, Ltd., 1924. 30s. net) appears opportunely at a time when the question of grass versus arable is seriously engaging the attention of British farmers.

The book deals with the principles of pasture-making, both temporary and permanent; choice of seeds; seeding conditions; subsequent care and management in respect of both hay and grazing; hay-making; ensilage; and seed-growing. It concludes with a short chapter on the breaking up of pasture, and an appendix devoted mainly to the work of seed firms and the mixtures of seeds recommended by them for different soils and climates

In his treatment of the subject the author takes an independent line, and is perhaps rather inclined to exaggerate the difference between his own views and those of other grass experts. Many, however, may be disposed to agree with him that as a result of isolated experiments undue prominence has sometimes been given to basic slag and wild white clover as the universal means for improving or making a pasture, and that unwarrantable deductions have been made from the effects induced by the continuous cake-feeding of one class of stock on land naturally poor and lacking in phosphates.

On the other hand, the author would seem to cling too rigidly to the ancient dogma of "lean years" following the first flush of herbage in the formation of a permanent pasture. He makes out a case, however, for a more general recognition of the value of nitrogen and humus in pasture improvement, and indicates the need for a proper balance of the several food ingredients required by plants. In his advocacy of humus he might, with advantage, have differentiated between "a deep turf of roots" and a turf of matted fibres.

The chapters on the management of permanent pasture and on haymaking are essentially practical and useful. In the latter a warning is given against the not uncommon practice of judging of the suitability of the manurial dressings from the recorded weights of hay, regardless of the constituent species. In his methods of sowing Mr. Malden finds a place for the drill as well as for the broadcasting machine, and he might even have gone so far as to suggest that, in certain circumstances, the disc drill is about the only sure means of securing an adequate covering of the seed. For the destruction of ant-hills he has nothing more effective nor economical to suggest than the spade or plough. Has he never tried heavy drag harrows?

In his choice of seed-mixtures, Mr. Malden favours the so-called "safe" plan of including a little of many species regardless of the factor of competition. It is unfortunate that the mixture selected by the author as a basis for prescriptions in general contains no perennial rye-grass.

Sound advice is given on renovation, and the hopelessness of obtaining profitable results from merely sowing away poor land to grass is sufficiently indicated.

The book contains much useful information gleaned from observation and experience, but it suffers somewhat from its great length and needless reiteration.

In a volume of this quality certain obvious errors are unfortunate, such as the wrong labelling of a very good illustration of Meadow Foxtail as Meadow Fescue (p. 228), and the statement that present-day basic slag only contains 15 per cent. of phosphoric acid.

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ADDITIONS TO LIBRARY.

Agriculture, General and Miscellaneous.

Ainsworth-Davis, J. R.—The Principles of Agriculture. (275 pp.) London: Methuen & Co., 1924, 7s. net. [63(022).]

Prjanischnikow, N.—Die Düngerlehre. (462 pp.) Berlin: Paul Parey, 1923. [62.16(02).]

Corrie, F. E.—Manuring for Profitable Production. (24 pp.) The Author, Star Cottage, Lingfield, Surrey, 1924, gratis. [63.16(04).]

Field Crops.

Malden, W. J.—Grassland Farming, Pastures and Leys. (338 pp.) London: Ernest Benn, 1924, 30s. net. [63.33(02).]

Brenchley, W. E.—Manuring of Grassland for Hay. [Rothamsted Monographs on Agricultural Science.] (168 pp.) London: Longmans, Green & Co., 1924, 12s. 6d. net. [63.33-16.]

Greening, C. B.—The Tragedy of our Grassland. (27 pp.) Reprinted from "The Fertiliser and Feeding Stuffs Journal," 1923. [63.33-16.]

Live Stock.

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